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T. COMMERFORD MARTIN, JOSEPH WETZLER, Associate Editors.
WM. A. ROSENBAUM, Asso. Editor Patent Department.
CLARENCE E. STUMP, Business Manager.
WALTER T. HUNT, Advertising Dept.

New England Office, 178 Devonshire Street, Boston.
W. I. BARKER, Manager.

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Our Index of Advertisements. WE would direct attention to the re-classification which has been made of advertisers in our Index to Advertisements on page ii. As it now stands, the Index not only includes the old arrangement by class of business or supplies, but gives an alphabetical list of the advertisers, thus rendering reference far more easy.

Organ Blowing by Electricity. WE illustrate on another page an application of the electric motor to the blowing of organ bellows. This special use of the motor proves, as will be seen, to be highly successful. The motor, occupying practically no space at all—about a foot square—is under the complete control of the organist, and does its work to the utmost satisfaction. Church organs blown in this way will soon cease to be a novelty.

American Apparatus for London. A SPECIAL dispatch from London last week says: "George Westinghouse's electric company has been awarded the contract for a plant to light the city of London, to cost about $800,000. It will be the largest plant in the world." We understand that the sale above referred to has been made to the Metropolitan Electric Supply Company, and that the apparatus for a first installment of the total 25,000 lights contracted for is already on the spot. We are glad to see that American electric lighting machinery has once more captured the English market.

Incandescent Lamps and Static Discharges. THE experience of a correspondent, which we print in another column, on the cause of the rupture of incandescent lamps when placed under the prolonged influence of a static electric charge, will go far towards clearing up what has to many appeared as a mysterious action. Our correspondent notes the fact that lamps destroyed in the manner indicated all showed a minute perforation of the glass bulb. With this fact established, the reason for the failure of the filaments is apparent, the inrushing air being thus the final agent of destruction. The remedy to be applied in such cases is also indicated, and is so simple and well-known that there ought to be no further loss from this cause, once its true character is determined.

The Telephone in Indiana. IT will be noted from the report in our columns this week of the decision rendered in the Cushman case by Judge Blodgett at Chicago, that the telephone companies are sustained in their contention that they can withdraw from service in any locality if they wish to do so, without invalidating the patents under which they operate. Although resting under an injunction for infringement, the Cushman Telephone Company held that they were at liberty to operate in certain places in Indiana, because the Central Union Company, using the Bell telephone, declined to give service as required by the State law, and had virtually gone out of business. This is plausible, as one can hardly be said to compete with another party who is not competing, but the court has rightly held that that view of the matter is irrelevant. If the Cushman telephone infringes the Bell patent and is enjoined, that is sufficient to stop the use of Cushman instruments, no matter whether there are only ten Bell instruments in use or ten million, nor whether the instruments are withheld from the public or not. In the latter case the patentee, by keeping back his invention, may suffer loss, but he does it at his own will, and there is no law to compel him to do business at rates which he considers unjust and ruinous. While we would like to see every invention utilized to the fullest, we are glad to find a court deciding that a patentee still has some right to his own ideas and property, and the disposal of them. As Judge Blodgett put it tersely: "The rule that because the patentee or owner of a patent cannot agree with those who wish to use his device as to the price to be paid for such use, authorizes another to pirate upon the patent with impunity, would be destructive of patent property." The plea set up by the defendant was tantamount to asking for such a rule, but even under the condition of affairs existing in Indiana, it is not to be entertained. As we have before pointed out, these decisions are far wider in their bearing than the telephonic issues to which they directly relate, and it is for the interest of all patentees that their rights should be thus maintained.

Dynamo Troubles. WHILE the electric lighting troubles which were formerly so common, especially sparking at the commutator of dynamos and motors, have, for the most part, disappeared with improved methods of construction and design in these machines, it is not out of place to be reminded occasionally of their cause; and an article in another column in which the source of this evil is pointed out will prove interesting to the student of dynamo-electric machinery. Mr. Serrell indicates clearly that trouble can be avoided by a liberal use of iron in the armature, and that statement implies the truth of the proposition which may now be said to be well established, namely, that while the fields of dynamos and motors should be as intense as practicable, the armature should possess as little magnetic strength as possible, in order to avoid the distortion of the lines of force emanating from the field magnets. Any interaction between these two magnets, one stationary and the other revolving, will cause the deflection of the lines of force, which necessitates the shifting of the brushes to maintain the proper point of commutation. We may remark, incidentally, that we were recently shown a motor armature, the commutator of which had been worn quite flat in broad, wavy lines or furrows in one spot, owing to the sparking action, for which particular phenomenon no adequate reason could be assigned. This will probably have been noted also by others, and the avoidance of it ought to be effected by proper supervision at the outset. We print this week, also, a note from a correspondent corroborating the reason assigned by us for a dynamo trouble, which consisted in the resistance introduced into a circuit by a loose screw contact. To those who have worked in the laboratory, and especially at fine measurements with the Wheatstone bridge and similar apparatus, the importance of obtaining perfect contact need not be dwelt on; but the dynamo attendant and the lineman cannot be too often reminded of the importance of bright and sound contacts, the lack of which may cause great annoyance, not infrequently considerable loss of power, and often loss of customers.

Defective Electrical Work. IT may be said that there are few kinds of engineering generally in which defective workmanship will so readily become apparent, as in the case of electric distribution for whatever purpose; whether it be an electric light circuit, a bell circuit, or a gas light circuit. In either case the smallest fault may cause an annoying interruption in the service, and usually the fault is one which cannot be readily gotten at or ascertained. In not a few cases electrical work is undertaken without special knowledge of, or regard to, the conditions which may obtain in the future, and while under the conditions existing at the time the work is installed it may answer the requirements of the case, forethought should always dictate the taking of possible troubles and accidents into consideration. It is to be hoped that the era of the poorly insulated wire is past, but the examples are still too numerous of results caused by the presence of moisture,—samples consisting in whole lengths of wire fused into a solid mass by the abnormal current or corroded by electrolytic action. Such was the appearance of a section of wire recently taken from a plant installed on ship board, which has now been replaced by wire better adapted to the conditions. Again, what might under some conditions be considered good insulation, may be quite defective under another. This is well brought out in the statements of recent correspondents, who sought advice on troubles in connection in gas lighting circuits. The smallest flaw here means a constant leakage of the battery and final inoperativeness; and though the troubles in this case may not be of as great consequence as those above enumerated, they are still of sufficient importance to require in an installation of this class work of the highest character as regards insulation. We are encouraged, however, in the belief that as time advances, these complaints will become less and fewer, and that their present existence is due rather to a lack of knowledge than to a wilful disregard of the requirements of the case. And we are strengthened in this belief by the remarks that we constantly hear made by installers of electrical work, that they find it difficult to obtain skilled help in the prosecution of their contracts. Even with the best materials, bad workmanship will offset their quality.

American Work and English Critics. ANY ONE who ventures out into a new field of theory or practice, will be greeted with criticisms more or less based on the facts of the case, and in this respect the work of Mr. Frank J. Sprague has been the cause of more discussion than usually falls to the lot of the engineering pioneer. From his communication, which appears in this issue, it will be seen that Mr. Sprague has found it necessary to reply to the animadversions of an English electrician, who called in question the practicability, on technical lines, of some of his recent electric railway work. We need not go into details, as our readers will be sufficiently informed by Mr. Sprague's reply as to the points at issue between himself and Mr. Snell. It seems as though American electrical engineering must for some time to come be subjected to some pretty sharp criticism from abroad, amid much generous appreciation, and the treatment it gets will, as a rule, not be unlike that which things American, as a whole, get at the hands of travelers who spend two weeks among us and then grind out two volumes of travel for Mudie's Library. It will require some time to convince the touring electrical engineer that it is not safe to draw hasty conclusions; and where the critic has not been among us, there is a liability to even more serious error. In view of the well known enormous extension of electrical applications in America, as compared with the backward condition of other countries, it is reasonably fair to assume that, although some poor work can be detected, experience, if nothing else, has given us a very thorough knowledge of the various problems in electrical engineering, and of the best solutions for them. It will be admitted, we think, that America has had occasion to borrow very little of electrical practice from Europe, and for that little has made a more than handsome return. In this instance Mr. Snell represents, and ably too, the critical spirit with which American advances are regarded, but he would, we opine, rather have matters the other way round. It is not a good division of labor for America to do practically all the hard work and Europe do all the fault finding. Perhaps if we could swop a few of our practical men for a few of our foreign critics things would be nearer to equality. There certainly would seem then to be more chance for the general use of electrical applications abroad.

A Few Points About Sparking.

BY L. W. SERRELL, JR.

As the title might be taken by the romantic to refer to something occasionally mentioned in country ballads, which might seem out of place in a technical journal, I would say, both in justice to the editors and myself, that I refer merely to that troublesome occurrence which makes the commutators and brushes on our dynamos and motors so short lived.

Frequently our dynamo and motor tenders who take pride in keeping their machines looking clean and neat, and who try so perseveringly to keep the dull glossy look on their commutators which betokens an absence of

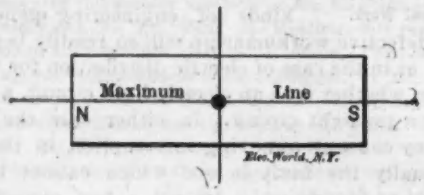


FIG. 1.

spark, are irritated and harassed, after a half hour spent in trying to adjust their brushes, to find that they have not succeeded; or if they do succeed and walk away with an air of satisfaction regarding their work, they return a few minutes later to find their machine sparking as badly as ever; but if they are observant they will notice that the return of the spark is always accompanied by a change of load.

Why should this produce sparking? By a shifting of the neutral line? And if so, what should cause the neutral line to shift? Let us see.

Suppose we have two bar magnets, Fig. 1, placed one on top of the other with their north poles and their south poles together. The maximum line will be in the direction of their length, while the minimum line will be at right angles to the same. Fig. 2 shows the upper magnet rotated through an angle of 90 degrees, in which case, if the poles be of equal strength, the maximum line will bisect the angle included between the magnets, the neutral line being at right angles to it, as before.

It is evident that if one magnet be weaker than the other, the maximum line will divide the angle $A\ O\ C$ inversely proportional to the strength of the magnets.

Letting S = the induction of the magnet $N\ S$; S' = the induction of the magnet $N'\ S'$, we obtain

$$S : S' :: \frac{1}{\angle BOC} : \frac{1}{\angle AOB} \text{ or, } \frac{S'}{S} = \frac{\angle BOC}{\angle AOB}.$$

Now if $N'\ S'$ were an electro-magnet, so arranged that its strength could be varied, the maximum line would change its position with every variation in the strength of the ma gnets, and consequently cause a shifting of the neutral line.

The action is similar in our dynamos and motors. Fig. 3 represents a pair of pole pieces with their maximum and minimum or neutral line in the position shown, and Fig. 4 represents an armature ring with the brushes in the position shown, the poles being formed where the current enters, causing the maximum line to coincide with a line through the point of contact of the brushes. Now, if the armature be placed between the fields, as shown in Fig. 5, the line of maximum action will depend upon the relative inductions of the field magnets and the armature, and will assume a position approximating that shown in the figure,

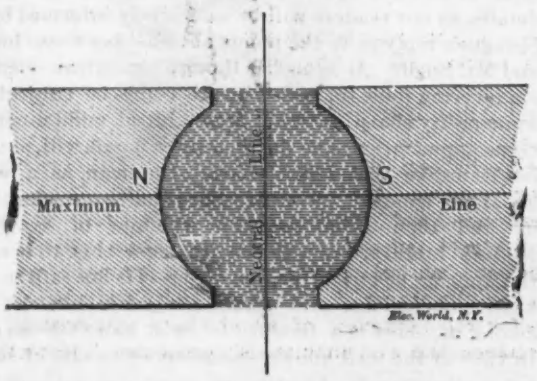


FIG. 3.

while the neutral line will be at right angles to it, as before; consequently the brushes should be adjusted to this position. The position which the resultant neutral line takes either forward or backward from the neutral line when the fields alone are considered is commonly known as the magnetic lead or lag.

In constant potential dynamos and motors, when simply shunt wound, we have a constant field. The ampères of current flowing through the armature proportion themselves to the load upon the shaft, while the position of the neutral line depends upon the induction in the armature and is determined by the ampère turns of wire upon the same, being shifted with every variation of current which accompanies every change of load, hence we have a case similar to the permanent magnet and electro-magnet before cited.

The induction in the armature can only be diminished by using fewer wire turns upon the same, as a certain number of ampères must be supplied under a certain pressure to develop a given amount of power; consequently a machine properly designed, in which the sparking shall be a minimum, must have the strongest possible field which can be produced, while the iron in the armature core must have sufficient area of cross section to conduct these lines of force below its saturation point. Under these circumstances we obtain an armature of low resistance, a machine of high efficiency and excellent regulation.

In constant current dynamos and motors, in which the strength of the field is varied while the armature has a constant induction, it is much more important to make the wire turns on the armature as few as possible; for if we diminish the strength of the more powerful field magnets the ratio of the armature induction becomes greater and greater, causing a considerable rotation of the neutral line. Those who have seen dynamos and motors running on constant current circuits have always been impressed and frequently wondered why they should spark so much more than the incandescent machine. Why not build these machines with a constant field and regulate the volts automatically in the armature?

I am aware that many people believe that the position of the neutral line will be changed by a change of speed, but experiment proves that when the current in the armature is constant and the strength of the field remains the same, a change of speed has no effect upon the position of the neutral line.

By referring to Fig. 5 we see that by shifting the brushes into position at the neutral line of the combination we also shift the poles of the armature, and consequently change the position of the line of maximum action, causing the neutral line to rotate still farther back. This repeats itself each time we shift the brushes, so that, theoretically, it is impossible to place the brushes on the neutral line, but the fact that the brushes have thickness and cover quite a little of the periphery of the com-

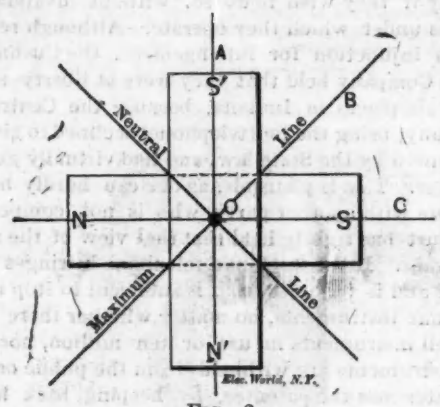


FIG. 2.

mutator makes it possible, if the machine be properly designed, to run with absolute freedom of spark under all variations of load within the capacity of the machine.

Curious Light Effect in Incandescent Lamps.

BY P. H. VANDER WEYDE, M. D.

The phenomena described under this head in the last issue of THE ELECTRICAL WORLD are very familiar to all who have experimented with Geissler tubes in connection with the Rumhkorff induction coil. The latter apparatus also gives alternating currents. There is a difference, however, between the latter and those produced by the alternate current dynamo, namely, that in the latter case the two currents are of equal strength, while in the induction coil the current produced in the secondary coil by the break in the primary is much stronger than the contrary current produced by the make of the contact. The cause of this is the self-induction in the primary, which at the break of the battery current increases its intensity. The reason is that every break induces a current in the same direction, while every make induces a current in the opposite direction; the latter will therefore counteract the battery current at its starting moment. Hence it is that the two alternating inductive influences are far from being equal, and consequently the two induced currents generated must be unequal also.

An incandescent lamp may be considered as a peculiar form of Geissler tube; it has also its highly rarified air, with conducting wire reaching into the interior. If the outside of a Geissler tube is partially brought in contact with a strip of tin-foil, a saline solution, the hand or any other conductor, and then one of its conducting platinum wires be connected with one of the ends of the secondary coil of an inductorium, the other end of which is connected with the conductor, touching the exterior of the tube, the effects referred to are readily observed. I possess a vacuum tube more than three feet long, with no metallic connections, but entirely hermetically sealed, which, when taken in the hand at one end and moved with the other end in the neighborhood of any alternating source of electricity of high voltage, will exhibit the most beautiful play of glow-worm, moonlight, phosphorescence, aurora borealis effect, or whatever it may be called.

In the case described in regard to the incandescent lamp, the saline solution surrounding the lower part of the lamp is a kind of external coating of a weak Leyden jar which, according to the law of inductive attraction of opposite electricities, will predispose the carbon of the lamp as well as the surrounding highly rarefied air to admit readily the alternate charges in exactly the same way that a Leyden jar will readily absorb a charge when its exterior coating is connected with the opposite electricity; the copper wires dipping in the salt solution used as an external coating establishing this connection. When there is no outer coating to a Leyden jar, or if the outer coating is insulated, it cannot be charged; so, also, with the lamps in question, wherefore the conducting salt solution and its connection with the other conducting

FIG. 4.

wire is essential. So is also the resistance R, the function of which is to increase the potential of the upper wire, and the lower wire, or the interior of the lamps and the salt solution surrounding them.

It is a very old and, alas! still prevailing error, not yet sufficiently rooted out, to ascribe all such and similar phenomena to the passage of electricity through the glass. If this were possible, it would involve the impossibility of charging a Leyden jar. Only static electricity of very high potential can, with proper and extra precaution, be made to penetrate glass, and if it is made to do so it invariably breaks it. Leakage is, therefore, out of the question, but it is simply the result of the rapidly alternating charges which the interior of the lamps is undergoing, and which, as explained above, can only be received in presence of a conducting exterior partially surrounding the lamps. This is further proved by the absolute necessity of every condition prescribed in the article, the omission of any one of which annuls the phenomena entirely.

The Copper Syndicate.

The *Financial News* learns that M. Secretan is expected in London shortly for the purpose of taking the necessary steps to turn his copper syndicate into an English company under the Limited Liability Acts. It is given out that Messrs. Barings are behind the enterprise, and the support of the Rio Tinto group and the members of the existing syndicate is assured. The title of the new company has not been decided upon, but it will probably not include the word copper in any form. It will have for its objects the cornering of products generally, as opportunities may arise. It will be, in fact, a sort of international cornering syndicate.

Dynamo Troubles from Loose Screw Contacts.

To the Editor of The Electrical World:

SIR: I am reminded by the trouble of your correspondent, S. D., at Jefferson City, Mo., of a similar trouble I had once while in charge of a plant of the Thomson-Houston system. I had a twenty-five lighter which refused to generate. Testing with a magneto showed the circuit to be all right. I stopped the machine again, and measuring,

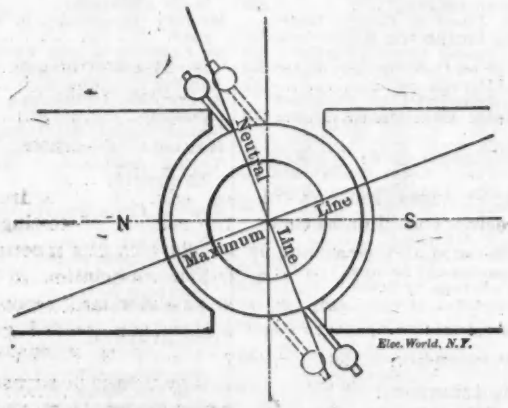


FIG. 5.

found the resistance of the circuit to be 1,120 ohms. After examining all connections I started out myself to find the trouble (having before sent a man over the line who reported everything all right). After going a half mile or more I found the trouble in a loose screw in the hanger-board of an out-door lamp. I tightened the screw, went back to the station and started the machine without trouble.

Now, speaking of testing, I do not like an ordinary magneto for that purpose. The bell is wound to a high resistance so as to be actuated by very feeble currents, and if one is testing a long circuit, especially in wet weather, when there are most likely to be grounds, crosses, etc., one is quite liable to get a false ring, due to the electrostatic capacity of the line. To remedy that I would put a commutator on the armature of the magneto and send a direct current to line, then any ring would certainly be due to a fault in the line. A. H. BURNETT.

Tests of the No. 2 Pentane Lamp.

Some tests upon the new form of lamp devised by Mr. Harcourt, and recently described in our columns, have been undertaken by Mr. Stepney Rawson on behalf of the Woodhouse & Rawson Manufacturing Company, in whose hands Mr. Harcourt has placed the manufacture of the lamp, and who had previously made the older form known as No. 1 Pentane Lamp. A sample lamp of the new form had been made under Mr. Harcourt's supervision at Oxford, and had been calibrated with his Pentane standard there. The form of the lamp has been fully described, and it is only necessary to say that the principle of it is founded upon the constancy of the light given by a portion of a flame of a certain height (variable between fixed limits) produced by the combustion of the vapor of a liquid mainly consisting of a definite chemical compound, whose composition, specific gravity and vapor density are constant within narrow limits. The liquid is known as Standard Pentane, obtained by purification and rectification from American petroleum. The tests were made to determine the following points:

(i.) The identity of light as long as the flame's height was within the given limits. (ii.) The identity of light given by lamps conforming in dimensions with the sample lamp. (iii.) The identity of the light given with the 1 c. p. gauge with that of the No. 1 Pentane lamp, which was in the maker's possession, and had been calibrated with the Oxford standard, and also with that at the Gas Referee's Office in London. (iv.) The accuracy of the 1.5 c. p. and 0.5 c. p. gauges, as sent with the sample lamp. (v.) The identity of the light given by the lamp under varying conditions of temperature. (vi.) The identity of light given by the lamp when burning standard pentane of specific gravities varying within the limits. (vii.) To find what difference of light could be detected by varying the dimensions of the lamp within narrow limits. (viii.) To determine the suitability of the lamp for practical everyday working in photometric tests.

A certain number of lamps were made and were at first roughly tested. A difficulty arose at first, owing to the leakage in these lamps of the vapor at the spindle, making it difficult to maintain the flame at a constant height. This was, however, completely cured by a drop of glycerine on the spindle, and as there is no action whatever of the pentane upon the glycerine, a small quantity will last a considerable time, and is quite sufficient to withstand the very slight pressure of vapor at that point.

The makers recommend the addition of a drop of glycerine from time to time. The method of testing was the same as that described by Mr. Rawson at a meeting of the Physical section of the British Association in 1886. An incandescent lamp is used as a standard, secondary batteries being employed and a Thomson graded galvanometer checking the constancy of the E. M. F. When the correct E. M. F. has been obtained by means of adjustable rheostats the platform of the galvanometer is moved till the needle exactly coincides with a division, and so a minute variation can be easily detected, such as one-twentieth of a degree in 25, or one five-hundredth part.

A 20 c. p. lamp was employed giving 14.4 c. p. This candle power was chosen because it is such as not to strain the filament in the slightest, and it also gives an illumination on the disc (of the Letheby pattern) very suitable for accurate work, and very similar in color to that of the Pentane flame. In addition to this, calculations were facilitated by the fact that each tenth of an inch on either side of the point (30 deg. from zero) corresponds to 0.8 per cent. for half an inch on either side. The bar was 144 inches in length and the readings were made to half divisions upon a metal bar divided into tenths of an inch.

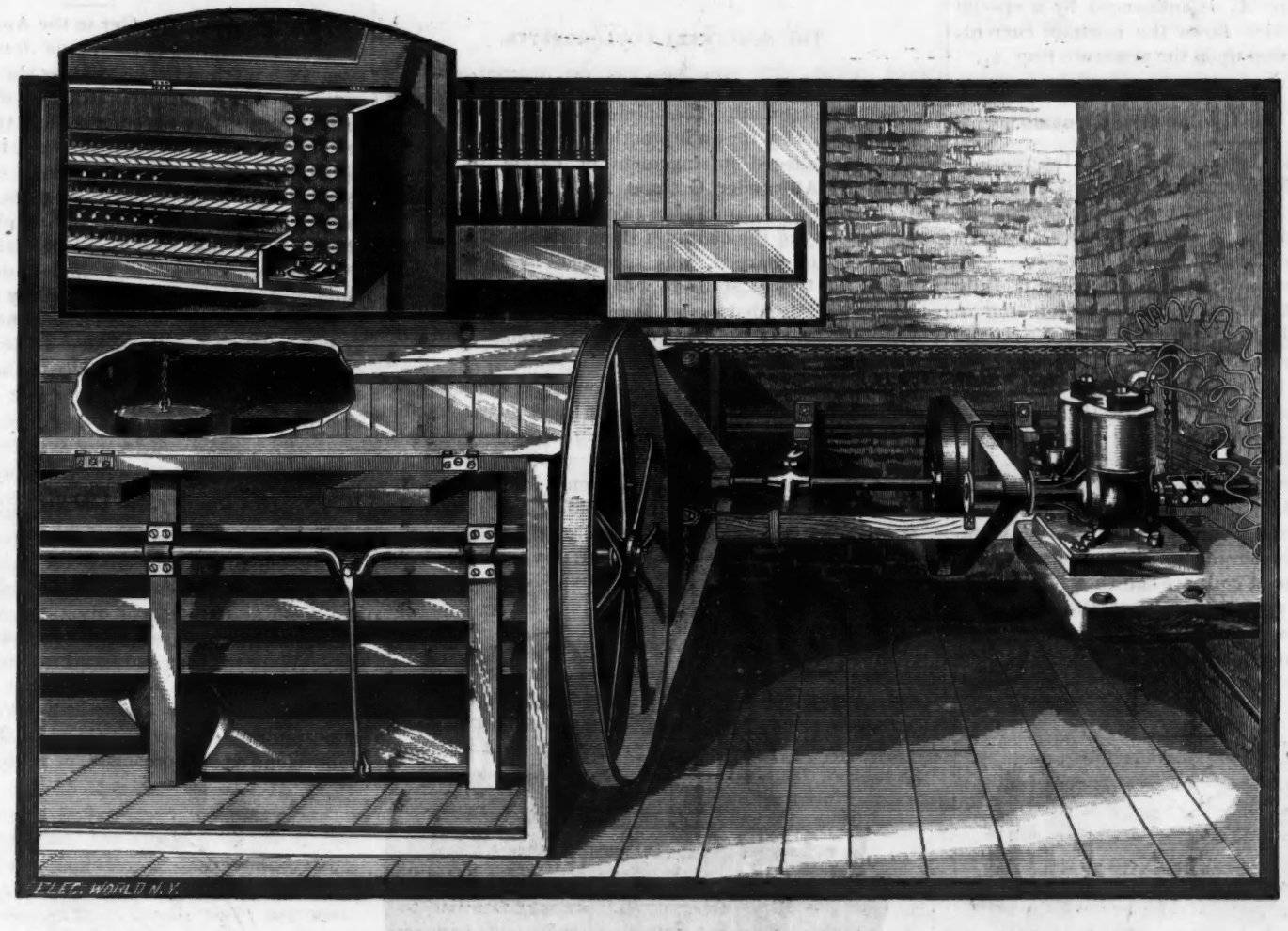
Lack of space prevents our giving the details of the various factors determined, as indicated above, but we may say generally that they showed the instrument to be remarkably constant in its indications.

Thus the length of time during which the flame will remain absolutely steady under ordinary conditions has been frequently tested, with results varying from 17 to 85 minutes, the difference being caused entirely by the variation in the temperature of the surrounding atmosphere. In order to reduce the change of height of flame due to this cause it has been found very advantageous to immerse the glass vessel up to the stopper in a vessel holding about three pints of water. The effect has been found excellent, and the flame has remained perfectly steady for a very long time. Even without this addition, the alteration in the height of flame with a rise or fall of the surrounding temperature is exceedingly slow, and is easily checked by a small movement of the wick.

To sum up, therefore, the result of the tests, the makers claim with confidence that the use of the lamp is attended with no practical difficulties or inconveniences; that the constancy of results is probably greater than our present methods of observation can accurately gauge: and that for compactness and ease of manipulation, independently of surrounding circumstances, the new form of the lamp leaves practically nothing to be desired.

The Lowrie-Hall System in England.

At Eastbourne the electric lighting is worked entirely upon the Lowrie-Hall system; all the consumers have converters and meters upon their own premises, and the supply has proved very satisfactory. Brighton is being adapted to the same system, about half the supply having been altered. The Lowrie-Hall regulator used in this system is extremely sensitive, regulating the difference of potential to within one volt. It is equally adapted to continuous as to alternating currents, as the regulation depends upon the lengthening effect of increased heat in a long thin wire. Briefly, the action is thus: The sag in the long stretched wire tips one way or the other a delicate balance-arm with platinum tips to which it is connected, and the current one way acts upon a solenoid to put in resistance in the field of exciter, and to decrease the resistance the other way. Besides the new station at West Brompton, a station will be shortly established at Headingley, near Leeds, on this system by the Headingley Electric Light Company, and a station will probably be also opened in the north of London.



ORGAN BLOWING AT ST. PAUL'S CHURCH, NEW YORK, BY ELECTRIC MOTOR.

Organ Playing by Electricity.

BY WILLIAM SIDELL CHESTER, M. E.

In a previous issue of THE ELECTRICAL WORLD allusion has been made to the use of electricity as a power for driving church organs. I now venture to give a description of the method of driving as used at St. Paul's Chapel, Broadway and Vesey street, New York city. The organ is a large three manual, built by the firm of J. H. & C. S. Odell, the case having been brought over from London in 1804. It contains forty registers, six of which belong to the pedal organ. It occupies a central position in the gallery on the west end of the chapel, and the bellows extend into a room at the rear. The bellows are 9 feet 6 inches by 7 feet 6 inches, and the air is supplied by three feeders, each of which measures 7 feet 6 inches by 2 feet 11 inches.

The organ, up to the middle of last August, was driven by manual labor, applied by means of a heavy driving wheel five feet in diameter. To supply full organ about forty revolutions of the driving-wheel are required. The motor used has a capacity of one horse-power, and receives its current from the Edison power circuit. The speed of the machine (about 2,200 per minute) is reduced by means of belting to a countershaft. From a 3-inch pulley on the motor, the belt runs to a 24-inch pulley on the counter, and from a 6-inch pulley on the counter to a 36-inch pulley on the driving wheel. The speed is, therefore, reduced forty-eight times.

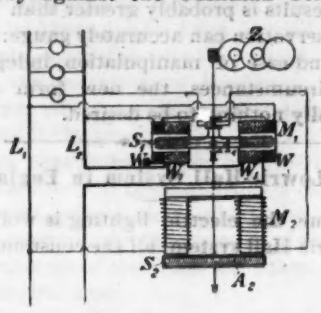
The motor is under the control of the organist, who merely has to turn the switch at his right hand, as shown in the accompanying cut. The regulation is as simple as it is ingenious, and is highly efficient in the freedom from any parts liable to get out of adjustment. The device consists of a loose pulley on a countershaft and a shifter whose motion is controlled by the upward or downward movement of the bellows. The shifter is fastened to a sliding rod which has on one end a ten-pound weight and on the other a weight of twenty pounds. The heavier weight is made to hang directly over the centre of the bellows, by having a copper sash cord run over pulleys, especially made with a square groove, leading directly to the position desired. This weight can be adjusted to any height, which point is called the point of cut off, and is usually taken where the bellows has received its fully supply of compressed air. When this point is reached, the heavier weight rests upon the bellows, and the lighter weight, attached to the other end of the sliding rod, draws the belt by means of the shifter on to the loose pulley. The motor then drives merely the loose pulley until the discharge of air is sufficient to cause the bellows to sink below the point of cut off, at which time the heavier weight again acts, drawing the belt on to the tight pulley, until the bellows are again filled. The motor is constantly running at a fixed speed, and the belt is automatically shifted as required. The advantages of the electric motor over any other power yet in use for driving organs are many and apparent. Among the most prominent are: The steadiness of its motion; the fact that the power is under the control of the performer; the very low cost of plant and running expense; the compactness of the plant; the cleanliness and freedom from parts likely to wear or to get out of order. That electricity is an efficient musical power has been proved by the successful working of the motor above described and by the favorable criticism of all who have witnessed its performance, and who unanimously pronounce it perfect.

The Influence of Joints in the Magnetic Circuit of Dynamos.

M. Larroque has recently carried out a series of experiments on this subject, which, although apparently not so exact as those of Professor Ewing and Mr. Low, lead to the same conclusions. It is therefore confirmed that the magnetic resistance of a joint diminishes as the pressure between the two surfaces increases, and that for the same applied pressure the resistance of the joint decreases as the total induction is increased. M. Larroque adds to this that in a practical machine when the iron approaches saturation the influence of mechanical vibration is so marked that the field is equivalent to that of a magnet of the same size and form without any joint.

Schuckert's Coulombmeter.

A new apparatus of the coulombmeter type, constructed by S. Schuckert, of Nuremberg, consists essentially of two electric motors M_1 and M_2, which are geared to one another in a suitable manner, and of which the driven motor M_2 serves to modify the speed of the revolutions which are indicated by the counter Z. This is accomplished by means of electric damping, so that the indications are proportional to the current to be measured within wide limits. The driving motor M_1 consists of an armature A_1, with an iron core through the winding of which, S_1 there passes a constant current, which is taken from the conductors L_1 and L_2 at two points having constant difference of potential. The freed magnets consist of a system of inducing solenoids, W_1, without iron (in order to avoid the change of magnetism and resulting error which might occur), through which passes the current to the measured. The driven motor M_2, the purpose of which is to absorb the energy developed by M_1, has an armature A_2, consisting of an iron core, having a winding closed upon itself, or covered with a better conducting material than iron. The currents generated in this closed circuit of wire or sheath on the armature A_2 cause the electric damping of the speed of both motors, M_1 and M_2. The magnet windings of the motor M_2 are included either in the circuit of the armature A_1 of the driving motor or are connected in parallel with two points of constant potential. In order to overcome all mechanical resistance, the armature A_1 is influenced by a special winding W, through which flows the constant current, and which exerts attraction upon the armature ring A_1.

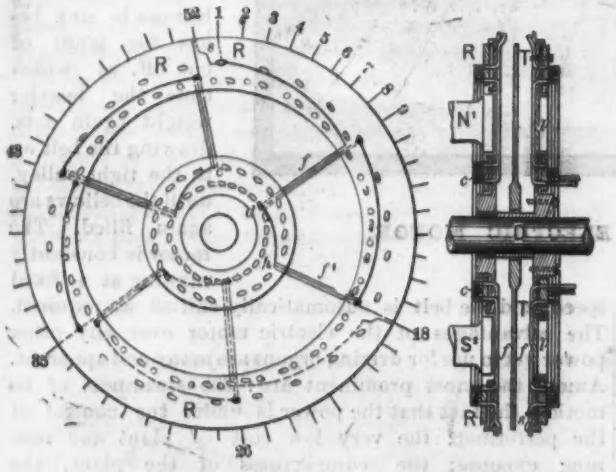


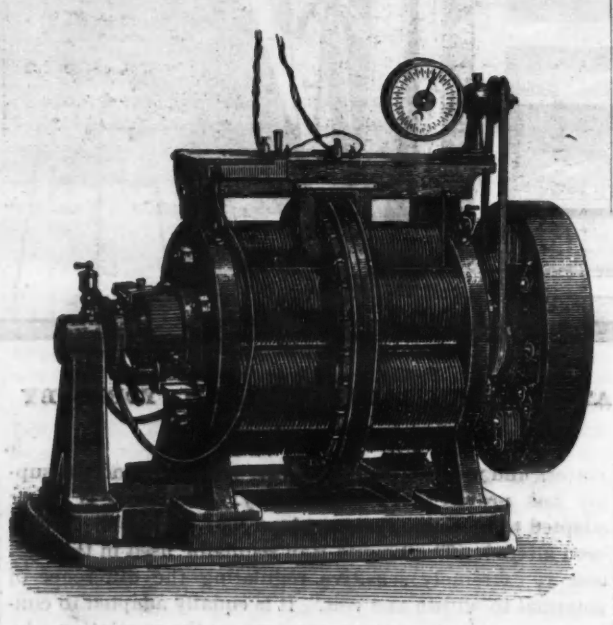
THE SCHUCKERT COULOMBMETER.

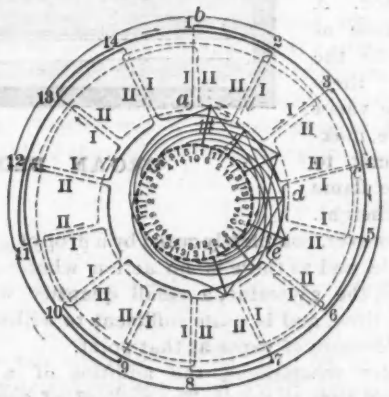
The Desroziers Multipolar Disc Dynamo.

In a paper read recently before the Société Internationale des Electriciens M. E. Desroziers described a form of multipolar disc dynamo. The winding, which characterizes the Desroziers machine, is shown in Figs. 1 and 2 arranged for an armature divided into 52 divisions. By this arrangement the space between the poles is fully utilized; each section has a well defined position, and an armature so constructed affords every facility for repairs and for inspection while at work.

By a modification of the collector and its connections, M. Desroziers has avoided an increase in the number of coils. He connects each triple coil, not to a single bar, but to three, 120° apart in the case of a six pole machine. The brushes, in lieu of uniting the ends of a triple coil, only unite the ends of a single coil, and each single coil is short-circuited several times under each brush at every revolution. This method of connecting up will be understood on examining Fig. 4, where 14 coils are shown connected up. In this figure there are distinguished the two discs which together form the complete armature; the wires of the upper half are shown in full, and dotted as they would appear with the centre of the disc taken away; those of the lower half are shown by disconnected dashes. The method of joining up to the collector bars is clearly shown. The single arrows indicate the path which the current would take in a short-circuited coil if the number of bars on the collector were not increased; the double arrows show the path taken when each coil is connected to three bars. The connections would be inextricable if the inventor had not made use of the properties of the involute. The wires are, therefore, all united to a special piece of apparatus, called the analyzer, and which is placed between the disc and the collector. The three wires of each coil come from the centre of the armature to an insulated disc; wire 1 passes on straight to the collector bar; wire 1′ is wound in involute on one side of the disc, and runs thence to bar 1′; wire 1″ passes through the disc, is wound backwards through 120°, and terminates at bar 1″. In this way all the wires are arranged side by side on either face of the analyzer, and no mistakes are to be feared. It is not necessary to enlarge further upon the practical advantages of these arrangements, allowing as they do very satisfactory working of the collector. It would be impossible otherwise to stop sparking without increasing the number of coils, or increasing the distance between the successive poles.







FIGS. 1, 2, 3 AND 4. THE DESROZIERS MULTIPOLAR DISC DYNAMO.

Four Desroziers machines, Fig. 3, have already been built by the firm of Bréguet, and placed on board the "Formidable" at Lorient. These machines weigh 2,640 pounds each, run at 350 revolutions, and have an output of 175 ampères at 70 volts; their electrical efficiency is 82 per cent., and their commercial efficiency is 79 per cent.; it varies very little with the work. According to the inventor it is very probable that the efficiency of the Desroziers dynamo would be considerably higher if constructed to meet ordinary commercial requirements.

The Cushman Telephone Case.

Judge Blodgett, in the Federal Court at Chicago, on Oct. 29, delivered an opinion in the case of the Bell Telephone Company against the Cushman Telephone Company. It grants an injunction to the Bell Company against the Cushman. The opinion reads as follows:

This is a motion for an injunction *pendente lite* by reason of the alleged infringement of Patent No. 174,465, granted to Alexander Graham Bell March 7, 1876, and Patent No. 186,787, granted to said Bell Jan. 30, 1877.

The validity of the claims of these patents, of which infringement is charged, was sustained by the Supreme Court of the United States in what is known as the "telephone cases," decided at the October term, 1887, and reported in length in 126 United States Supreme Court Reports.

Defendants admit that they use what is known as the Cushman telephone, and the telephones made by that company were held by this court to infringe the complainants' patent, and the claims now in controversy, in the case of the American Bell Telephone Company vs. the Cushman Telephone Company decided in July last.

Defendants are engaged in furnishing telephone service and operating telephone exchanges in several cities in Indiana, and insist that an injunction should not be granted on this motion because a few years since the complainant's grantees or licensees established telephone exchanges and furnished telephonic accommodations in some, if not all, of those cities, but withdrew therefrom after the passage by the Legislature of Indiana of an act limiting the rates of charges for the use of telephones and telephone service.

I do not think the fact that the complainant's licensees or grantees have withdrawn their telephonic accommodations from these cities furnishes any excuse or defense for the infringement of these patents by these defendants. The law gives the owner of a patent the exclusive right to the use of the device covered by his patent, and the rule that because the patentee, or owner of a patent, cannot agree with those who wish to use his device as to the price to be paid for such use, authorizes another to pirate upon the patent with impunity, would be destructive of patent property.

Counsel for the defendants insist that the main question involved in this case is the validity of the Indiana statute regulating the charges for telephone service, but I do not consider that question involved in this motion. It was stated on the argument of this motion, and I doubt not truly, that this question is in the way to be presented at an early day to the Supreme Court of the United States, which is the proper tribunal to pass upon it. But it would be strange indeed if, when A is the undisputed or adjudged owner of a patent which B wishes to use, but B is not willing to pay the amount demanded by A for such use, therefore C can infringe the patent and supply B with infringing machines and not be restrained from so doing, when the validity of the patent and infringement are clear.

It was urged upon the argument that this court had decided in the former case of Hoe vs. Knapp that a patentee who did not put his patent into use was not entitled to an injunction, and that decision was invoked on the argument of this application for an injunction. I, however, think that the case there made was another and widely different one from this. There the patentee had never made a machine nor put his patent into use, nor allowed another person to put it into use; he had simply locked it up, so to speak, and kept the public from the benefit of it. Here the patentee has put his patent into extensive use, and is receiving a large income for such use at rates agreed upon between the owners of the patent and the user. So that this complaint does not stand as the complainant did in the case cited.

An injunction will be granted according to the prayer of the bill.

Interception of Messages

M. H. Discher, controller in the Austrian postal service, in a communication to the Berne *Journal Télégraphique*, suggests a method for preventing the interception of messages in war time. He remarks that whereas it was formerly necessary to cut the line, the invention of the telephone now renders it possible to read every Morse signal passing along the line from a considerable distance by erecting a parallel line of short length with a telephone in circuit. He recommends the employment of the duplex system, one station sending the proper telegrams while the other transmits some text determined on beforehand. The signals then received by any instrument interposed on the line, or by a telephone on a neighboring and parallel line, will be so confused as to be unintelligible. He refers more especially to the employment of the Morse instrument, as this is the one most generally used in field operations.

Electric Phenomena Accompanying Tornadoes

The Signal Office of the War Department, in anticipation of obtaining data of future storms, has prepared for circulation a formula asking for information relative to tornadoes. The circular is being distributed throughout the West, and among the questions are the following relating to the electrical phenomena accompanying tornadoes: Were thunder and lightning observed, and if so, in what portion of the horizon, at what time of the day, and whether violent or otherwise? Was lightning or any manifestation of electricity seen in the funnel-shaped tornado cloud as it approached, or in the dark, heavy clouds surrounding it to the north and west? Note the deflection of a magnetic needle before and after the storm. Is there any reason to suppose that the clouds approaching from opposite directions preceding the first appearance of the funnel-shaped cloud were oppositely electrified? Note if the motion of the approaching cloud appears to be accelerated at the moment of, or immediately following, any electric discharge. What portion of the tornado cloud presents the lightest color? Did the upper portion of the cloud at any time present a glaring appearance like the colors of a brilliant sunset? Were "balls of fire" observed to occupy the tornado cloud at any stage of its progressive movement? What effect had the storm upon small vegetation and the foliage of trees? In the event of death or injury to any person or animal observe very carefully whether the effect resulted from the electrical discharge or the force of wind. Did you notice any peculiar odor in the atmosphere during the passage of the storm? Can the roaring, which always accompanies the tornado cloud in its passage over the country, be readily distinguished from ordinary thunder? Is thunder ever distinctly heard as emanating directly from the tornado cloud? How were the telegraph wires affected

The Electric Launch "Viscountess Bury."

The "Viscountess Bury" was launched from the builder's yard at Chiswick, England, on Monday, Oct. 8. This, according to the London *Electrical Review*, is the largest electrical boat which has yet been seen on the Thames, or probably in the world, if we except that of Mr. Elieson. She is intended for public use, and will carry upward of 80 passengers comfortably.

The "Viscountess Bury" has been specially designed and built for a private company by Mr. W. Sargeant, electrical launch architect and constructor, Chiswick. She

THE STORAGE LAUNCH "VISCOUNTESS BURY."

is 65½ feet long with 10 feet beam and has a mean draught of 22 inches with a displacement of 12½ tons.

Mr. Sargeant has designed a rudder on an entirely new principle with the object of clearing weeds, obviating stern post dead wood and gudgeons, with facilities for quick removal and easy steering. This rudder will be built up of thin steel, galvanized, and slung in a gun-metal trunk. The steering wheel is situated right forward on the deck, as shown in the illustration, so that the man operating has full view of all small craft which so numerously frequent the higher reaches of the Thames in summer. Adjoining the steering wheel will be an indicator communicating with the electrician in charge of the switches controlling the electrical power.

The electrical energy is stored in 200 Electrical Power Storage Company's accumulators of the "1888" type, each of which has a capacity of 145 ampère hours with a discharge of 1 to 50. The midship section of the vessel being perfectly flat, there will not be any lids on these boxes, so in the event of her running aground the acid will not slop over. These storage cells are arranged, one hundred on each side of the vessel, under the seats. The space occupied by them is lined with lead, small drains leading into receivers in case of accident, thus securing perfect dryness for the boxes. The cells are computed to hold electrical energy sufficient with one charge to propel the vessel for 10 hours at a speed of six miles per hour, as regulated by the Thames Conservancy by-laws. There are two 7-inch Immisch motors, which convert the electrical energy into power. These are calculated to develop 7½ brake h. p., at 1,000 revolutions per minute. They are placed under the floor aft, each working direct on to one of the twin propeller shafts. The thrust is taken from a ball-bearing thrust block, which reduces the friction greatly. The switches are fixed, port and starboard, and are two to each motor, one for half and full speed, the other for going ahead or astern. They are worked by the electrician in answer to bell signals from the man at the wheel. Each propeller can thus be worked independently of its twin companion, and so greatly assist the steering in sharp bends of the river. In place of the objectionable whistle of the steamers, a large and melodious ship's bell is placed on the cabin top, and may be sounded electrically by the man steering, the current coming direct from the accumulators. This bell will sound for warning boats and signaling lock-keepers.

All lights for port, starboard, masthead and cabin lavatories, etc., will be incandescent electric lamps supplied by the accumulators. Ammeters, voltmeters and suitable resistances are all under the immediate sight or control of the electrician. All the machinery is placed below the floor, leaving a clear space from stem to stern for passengers.

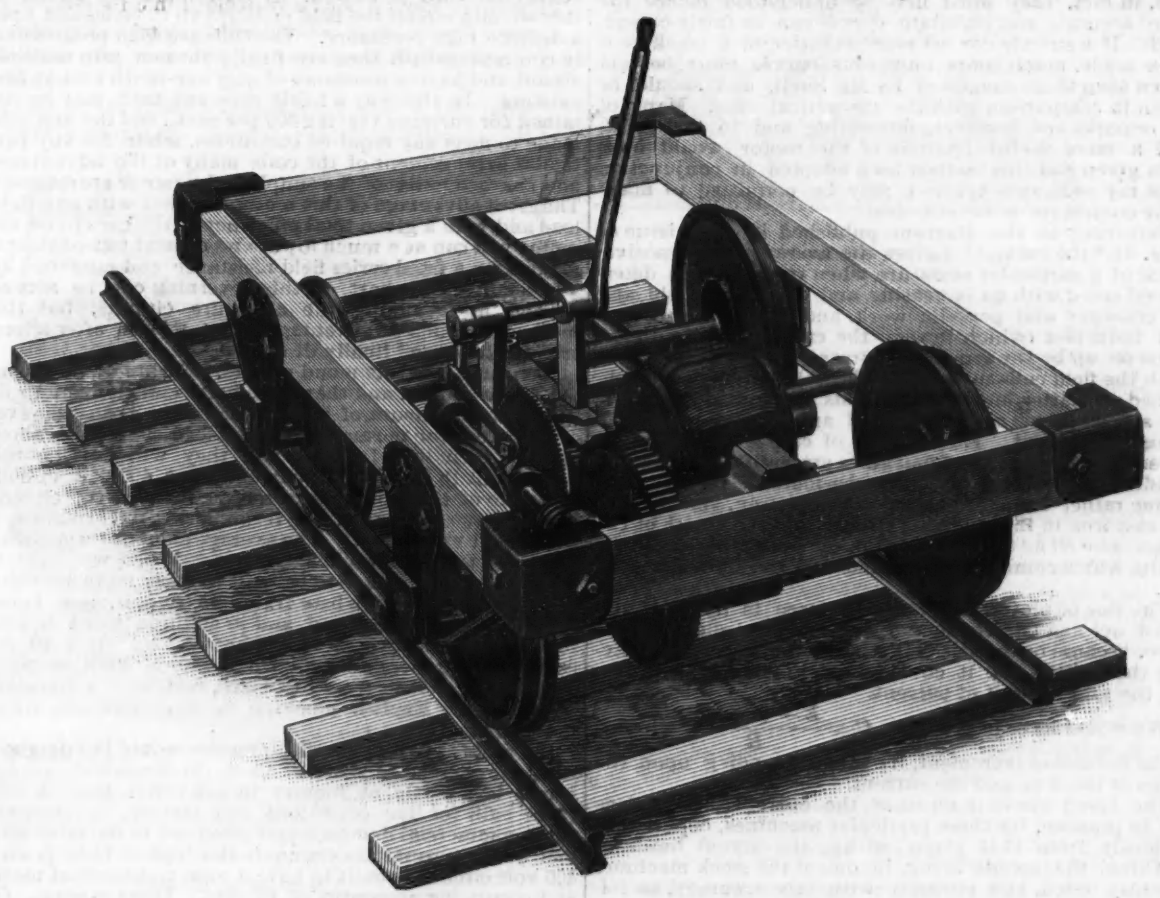
Novel Earth Plate.

Signor Baretta has invented a new earth plate, which consists of a sheet of corrugated copper or iron rolled in the form of a cylinder, about 30 in. in diameter, and the same in height. The corrugations are furnished on the interior and exterior with conical points of copper, and the free edges of the plate are cut in zigzag teeth. A large surface of contact with the soil is thus obtained. In dry and rocky places a 5-foot trench is dug, and a first sheet of corrugated copper is laid horizontally upon a layer of small coke; another layer of coke and a second plate is laid on this, and the two plates are connected together. A third layer of coke is placed on top, and the whole filled up with earth.

The Jones & Rogers Gearing for Electric Motor Cars.

We illustrate on this page a new gearing for electric street cars, brought out by Messrs. Jones & Rogers, mechanical engineers, of Cincinnati, O., who have carefully studied the requirements for this work.

No specially designed motor is required for the arrangement. The commutator shaft, as will be seen in the accompanying engraving, carries a small pinion driving the large gear, which is loose upon the axle. This large gear carries a double differential train of gears, the centre one of which on one side is keyed to the axle, the centre on the opposite side being loose upon the axle, and having a sleeve to the end of which is firmly keyed a worm gear. These two gears, acting in conjunction, always run backwards as fast as the motor runs forward if they are not controlled, and the centre gear on the axle opposite to them stands idle. By retarding their backward motion or holding them fixed, any speed may be obtained by the axle, through the differential train, in either direction; or the axle may be firmly locked against rotation at the neutral point without stopping or altering the high speed of the motor. The regulation of speeds, etc., is accomplished by means of the large face gear on the commutator shaft outside of the small pinion above mentioned. This wheel drives a small pinion of peculiar construction, feathered on a splined shaft and free to travel across the face of the large wheel, and is operated by means of the lever shown in the illustration. The splined shaft has a worm meshing into the worm wheel



NEW GEARING FOR ELECTRIC CARS.

described above. The worm wheel, worm, shaft, pinion and large face gear taken collectively are called the governor, and by means of the operator's lever are used to start, stop, reverse and establish the speed at which it is desirous to drive the car; while the necessary amount of power required is transmitted through the heavy gears and differential train to the axle.

The illustration shows the small pinion on the splined shaft at its neutral position against the face wheel. With the motor running at its normal speed, the axle is locked. Bringing the pinion toward the right gradually until it reaches the outer edge of the face wheel, the rotation of the axles is positively and gradually increased backward until a speed of ten miles per hour is attained. Bringing the operating lever vertical again draws the pinion to its neutral point and stops the car. Pushing the lever forward, carrying the pinion toward the centre of the face wheel, starts the car forward, increasing its speed until the centre is reached, when a speed of ten miles per hour is attained. Crossing the centre, still higher speed is attained in proportion to the various diameters fixed by the governor. In all manipulations for varied speeds and powers required, no switches are needed nor is the motor reversed or slowed up from its constant normal speed. The method of gearing is also applicable to traveling cranes, elevator machinery and other work.

Callender Conduits in England and America.

To the Editor of The Electrical World:

SIR: I note in this week's paper you have an item on electric light work now being done at Whitehall Station, London. We would state that the conduits there were laid by our London house, under the Callender-Weber patents.

The compound from which they are made is purely asphaltic. This conduit has been practically adopted by all the new electric light stations now being put up in England, and is of similar construction to that we are now laying in New Haven, Conn.

Our London house has also the exclusive contract for all the underground cables for these new stations.

We would also say that we have just begun manufacturing the Callender-Weber conduit in this country, and have started to-day laying several miles of duct in New Haven, Conn.

WM. CALLENDER,
NEW YORK CITY, Oct. 25. Pres. Callender Co.

Effect of Static Charge on Incandescent Lamps.

To the Editor of The Electrical World:

SIR: Among the several articles that you have recently published in regard to the effect of static discharges on incandescent electric lamps I see nothing exactly similar to a case that recently came to my notice.

Most of the trouble occurred at a socket suspended by a flexible cord about 18 inches from a six-inch leather belt, not crossed. Six lamps were used up in an afternoon run of about 2½ hours.

On examining the lamps I found in each a small hole at a point on the bulb that would be touched by the bend of the filament if drawn to one side. The hole was about large enough to admit a cambric needle and was not caused by softening of the glass, but by fracture, and in some cases I found small bits of glass inside.

On approaching a good lamp to the belt the filament was immediately pulled toward the side of the lamp next the belt, the bend resting close against the glass; this effect I suppose was due to the glass being electrified by proximity to the belt and attracting the filament, the same as in the familiar experiment with pith balls. A touch of the hand to the belt was sufficient to cause the filament to fly back to its normal position. Two or three other pendants hung near belts have also contributed toward our collection of sixteen punctured lamps.

My remedy, for which I am indebted to Ben. Franklin, was to run a wire from the nearest steam or gas pipe to within about one-half inch of the belt, ending in a number of fine wires (from a bit of flexible cord), thus discharging the electricity as fast as generated.

Since putting up my miniature lightning rods I have had no further trouble. ANAC.

A Reply to Mr. A. T. Snell.*

BY F. J. SPRAGUE.

Your issue of Aug 31 contained a paper entitled "The Sprague Motors at Richmond, Va.," by Albion T. Snell, which, while deprecating any intent of captious criticism, contains at once with some interesting comments several most unjustifiable conclusions, which a fuller knowledge of the subject would have led him to avoid. I do not think the question whether the English electrical engineers have anything to fear from their brethren on this side of the Atlantic is an important one in this connection. Whatever the self-complacent conclusions to which Mr. Snell may have arrived, it is quite within the possibilities that all competent electrical engineers can design motors of equal electrical and mechanical efficiency where no limitations are put upon them; but what is a matter of more importance is, how far the purely electrical deductions of the school or laboratory shall be subordinated to mechanical and commercial considerations; and if we are to judge by the relative advances made in England and the United States I shink the credit can be claimed for the Americans of dealing with these questions in a more matter-of-fact and pertinent manner. This may be acknowledged after due weight is given to the difference between English and American public spirit and enterprise, which same difference may possibly exist between electrical engineers of the two nationalities.

Novelty alone does not win in the United States, nor would a knowledge of the business done confirm the opinion that liberality of public spirit is the chief reason of success. One thing seems to be forgotten by an Englishman when discussing things American, and that is the fact that a newly developing business of special character is carried on, with New York as a centre, in places which may be as far away as Boston or Halifax, Smyrna or Trieste, or Constantinople is from London, and that it may take seven days of continuous travel to reach a point where work is being progressed. Does a liberal public spirit, may I ask, guarantee the success of an enterprise under such conditions? If so, the public spirit of our people in this widely diversified country is indeed liberal.

Turning to Mr. Snell's paper I find that he asks concerning certain curves published in a paper read before the American Institute of Electrical Engineers, "Why were they ever published in their present form, especially in view of the omission of allowances for material friction, self-induction, etc.?" These omissions being so apparent, it would seem that Mr. Snell's statement concerning them, that they are theoretical curves, might have been accepted as a fair explanation and so treated. The curves are not, however, entirely theoretical. They are based partly upon experiments, partly on theory, and are useful for pointing out in a general way the approximate shape of certain characteristic curves of a motor under one condition of working, and some new uses to which such curves, assuming them to be correct, may be put. They have the same value that a theoretical steam diagram may have, and serve a purpose which is just as well attained for the layman as perfectly accurate ones, and, in fact, they must first be understood before the more accurate and elaborate curves can be fairly considered. If a strictly correct representation of a machine is to be made, much more numerous curves must be laid down than those suggested by Mr. Snell, and should be given in comparison with the theoretical ones. Many of his remarks are, however, interesting and to the point, and a more useful analysis of the motor would have been given had this method been adopted in conjunction with my own, and hence I may be permitted to make some comments on his criticism.

Referring to the diagram published in your issue of Aug. 31,* the curve $O\ A$ gives the average electromotive force of a particular armature when running at a determined speed with an increasing and decreasing field and for constant and periodic work, and takes into account self induction (which lowers the curve) and the distortions set up by the armature current which would exist with the field coils in a particular relation; it can be obtained no matter how the field coils are excited so long as the ampère-turns correspond and are proportional to the armature current. This curve is of course a variable one when a large number of machines are built and when the conditions of actual work are considered. Its flattening is due rather to scantiness of wrought iron, and the use of cast iron in the magnetic circuit, and the length of the latter, as well as to the distortion set up by the armature, faults which commercial demands are largely responsible for.

The line of motor electromotive force in terms of the resistance and current should, of course, be slightly concave, because of the self-induction of the coils when leaving the brushes, or it could be made straight by varying the graphic unit of current.

We would have in practice: $C = \frac{E-(e+e')}{R}$; where e' is the induction increment, its value depending upon the turns of the wire and the current.

The speed curve in terms of the current, $E\ D\ C$, does not in practice, for these particular machines, depart very seriously from that given within the actual limits of working, the speeds being, in one of the stock machines recently tested, and probably with fair accuracy, as follows:

Ampères	10	15	20	25	30
Sprague curve	1,167	900	775	6?0	630
Actual	1,185	946	806	687	603
Snell's curve	967	860	667	600	540

being thus greater than my curve readings when less than 25 ampères, and less than these when greater than 25.

As regards the work curve, it is an ordinary practice in rough work to plot it for H. P. $= \frac{C\,e}{800}$ instead of $\frac{C\,e}{746}$, and then allow for any intersecting work curve an increase of 10 per cent. for material friction.

Absolute accuracy is not quite practicable, except in a laboratory. The expression H. P. $= \frac{C\,e}{746}$ is a true one, but it does not of course represent the brake horse-power, since it includes useful work, air, commutator, journal and gearing friction, air fanning, work expended in generating eddy currents in the armature discs and binding bands and in the pole pieces, the work of overcoming self-induction in the coils leaving the brushes, and energy expended in short circuited coils. The aggregate of the prejudicial classes of work would nearly bring the curve $O\ F\ C$ to Snell's curve No. 4, but the ultimate reading of the characteristics of an intersection would be about the same as would be afforded by plotting the work curve as H. P. $= \frac{C\,e}{800}$, and allowing an increase of 10 per cent. in the equation for car work, as was done; the former method is of course a truer indication.

The curve $O\ D\ G$, giving the work of the motor in terms of its own speed, would, if plotted from $E\ D\ C$, corrected for self-induction, and $O\ F\ C$, corrected for material losses, be perfectly accurate, because it is simply based upon the facts indicated by these curves, and is plotted from transferred co-ordinates. Similar remarks are true concerning the curves of torsional effort.

Mr. Snell makes a most serious mistake when he assumes that these machines are designed to be run with the greatest normal output with half the maximum current; in other words, at about 14.5 h. p., and with over 50 amperes of current, and he points out the great loss which would exist under such circumstances.

He asks, "How long would a motor run with a furnace inside it?" and immediately afterwards says, "and note the car speed for this current is about three miles per hour, and so this must occur frequently." He then naively adds, "Well, the writer cannot explain this, etc." With the consciousness of this lack of explanation because of the knowledge that the assumption is entirely untenable, Mr. Snell should, it seems, have hesitated before jumping to hasty conclusions. True, it is said that the motors can for a short time work up to double their normal capacity, and considering the fact the line potential can be readily raised to 500 volts, and that for a few seconds under some very abnormal conditions, such as one motor being broken down on a very heavy grade or with a car off the track, a motor may be put under a most exceptionable strain, the remark is fairly true; but the assumption of Mr. Snell is that because the car must be often running at three miles per hour this over-load must be a normal condition of affairs. While I did not explain any particular method of governing these machines, I did say that they were commutated, and the key to the explanation lies in the difference between the English and my practice in street car motor government.

One of the things which are concerned is the total efficiency of the car circuit, which circuit includes the motors and the governing devices, but this is not all; the speed at which with a total determined car circuit efficiency series motors will run is of equal importance. There are three general methods of controlling motors; one (and it seems Mr. Snell's favorite) is to make use of external resistance, leaving the motor circuit undisturbed; another is to make use of both the external resistance and certain changes in the motor circuits; a third is to govern the motors entirely by variations in the arrangement of the field coils.

I have used all methods, but the last is characteristic of the Richmond machines. Their fields are wound with three sets of coils, varying in the number of turns, the cross-section of the wire, and the resistance; these are connected with a switch, so that when the motor is thrown into circuit the field coils are all in series and have a definite high resistance. The coils are then progressively commutated till they are finally thrown into multiple circuit and have a resistance of only one-ninth that at first existing. In this way a fairly constant field may be obtained for currents varying 300 per cent., and the motor be made to meet any required conditions, while for any particular arrangement of the coils many of the advantages and characteristics of the simple series motor are retained. The great advantage of this method is, that with any light load and with a given total efficiency of the car circuit the motor will run at a much lower and constant speed than if made with a fixed series field resistance and governed by a resistance coil: part of this governing can be accomplished by changing the armature circuits, but this method has such disadvantages that it was after a long trial in Richmond finally discarded.

As regards the Richmond motors, they are by no means perfect machines, and they have been called upon to do an abnormal amount of work, much more than was ever anticipated; the normal maximum load should be about 7½ h. p., including friction, and they will develop this with about 18 ampères of current on a 400-volt circuit. The ratio of the motor electromotive force to the electromotive force existing at the terminals of the armature is then about 93 per cent. The average current through the machines is not over 5 to 8 ampères. When we consider that the machines have to be built to work up to 500 volts, if necessary, with the base frame in circuit, and hence necessarily well insulated, and in addition must be able to stand instant reversal with a heavy load on a 10 per cent. down grade, and were, furthermore, built to meet certain demands in regard to space, cost, etc., I have yet to hear of an English machine to meet like conditions more successfully.

Mr. Snell says that English practice would be to make a machine of equal capacity of about .65 ohm resistance, but it may be a pertinent inquiry to ask *what* English machine built for like conditions and service, to meet the same commercial demands and governed in the same way, and with a normal maximum brake load of 7½ h. p. on a 400 volt circuit, is built to have a total resistance of motor and regulating apparatus of .65 ohm. There is none. On the other hand, on the same page, Mr. Snell says: "In ordinary English practice a motor absorbing 50 ampères and say 100 volts, and running an 8-ton car at about 5 miles per hour, would have an internal resistance of .25 ohm, etc." There seems to be some confusion in the unquoted part of this statement, but if the motor has .25 ohm resistance on a 100 volt circuit, it will measure, because of the increased space taken up by insulation, somewhere about 4.5 ohms on a 400 volt circuit, a considerably higher resistance than that of the Richmond machine. No grade being given for these figures of Mr. Snell, they are supposed to be for working on an English tramway at level; one of the Richmond machines will easily run such a car under the same circumstances about 6 miles per hour.

As a matter of comparison between English and American machines, possibly the following figures will give Mr. Snell food for reflection.

One of our latest railroad machines designed to work on a circuit varying from 400 to 500 volts, and up to a normal capacity of the former potential of 12½ h. p. has a resistance of about 1.4 ohms on the last step. The normal magnetic circuit outside of the gap is entirely of wrought iron, and the characteristic of the machine up to its normal load is very nearly a straight line and about equal to that of the best Edison-Hopkinson dynamo.

One of our earlier machines was a motor designed to develop 15 h. p. on a 220 volt circuit. A special committee from the Massachusetts Institute of Technology about a year ago tested one of these machines at 186 volts, a brake load of 21 h. p., and with about 60 per cent. current overload. Its commercial efficiency under these abnormal conditions was 78 per cent. Some of our standard machines have the following characteristics:

Capacity.	Volts.	Armature resistance.	Shunt field resistance.	Ratio of resistances.
20 h. p.	220	.028	150	1,829
25 "	220	.058	140	2,414
30 "	440	.228	440	1,930

The ratio of electromotive force to the initial when under full load is, say, for the 25 h. p. motor nearly 98 per cent., and all these machines have a commercial efficiency of over 90 per cent.

I should be glad to know of any English machines, whether of 1885 or 1888 design, which leave much to be desired in the above in the matter of regulation or efficiency. I have given these figures to show the uselessness of Mr. Snell's self-complacent disparagement of American machinery, and to emphasize the fact that any just comparison of designs should be made under like conditions, and any other comparison, whatever its motive, is not only unfair, but misleading. It will give me pleasure to show, possibly at an early date, the characteristics of the Richmond machines wound for storage battery work, and also the theoretical and brake curves of our heavier railroad and standard stationary machines.

* Copy of a communication sent to the London *Electrician*.

* See Fig. 1, Supplement to THE ELECTRICAL WORLD, July 21, 1888.

The Subways and the Steam Pipes.

The New York Board of Electrical Control met on the 30th ult., at its office, 1,218 Broadway. A communication was received from Mayor Hewitt, who forwarded to the board a letter from John A. Gano concerning a safety cut-out for electric wires. The secretary was directed to notify the Mayor that his communications had been received, and that Mr. Gano's letter had been handed over to the expert for investigation and for report at the meeting of Nov. 9.

Applications from the Brush Company, the East River Company, the Harlem Lighting Company, the United States Illuminating Company, and the Mount Morris Company for permits were received, and for the most part granted. An application from the Ball Electric Company for permit to run wires across Broadway, from the southwest to the northwest corner of Thirty-ninth street, was laid on the table. The United States Company were notified that no permits would be granted them in districts where their wires have been ordered to be placed underground. The Electric Power Company, of the city of New York, applied through Assemblyman O'Connor for permits to run wires on South Fifth avenue. On Mr. O'Connor stating that the company had the consent of the United States Illuminating Company to use its poles, and would only string wires for use pending the completion of the subways along the line, Commissioner Moss wished to see the written consent of the United States Company. Mr. O'Connor said it would be produced at the next meeting. Judge Kelly then rose and challenged the statement just made by Mr. O'Connor, on which the latter retorted that his business was with the board and he questioned the right of ex-Judge Kelly or any one else to interfere in the matter. After his departure, ex-Judge Kelly stated that he had just telephoned to the United States Company and learned from them that no permission had been given to the Electric Power Company, as stated. While thanking ex-Judge Kelly, the board was of opinion that it preferred to receive any further contributions to the discussion when both parties to it were present. A letter was received from the Mount Morris Company regretting the unfavorable opinion held by the board on the subject of its supposed delinquencies, and deprecating any intention of violating the rules and regulations of the board.

Chief Engineer Kearney and Expert Wheeler presented their report on recent investigations in the matter of the excessive heat in the subways. The report says: "The sole cause of the trouble is the heat caused by the escaping steam from the pipes. This brings the temperature of the conduits up to a point which none of the cables as ordinarily made for underground work can stand, and it is doubtful if any practical cable can be made which can stand the high temperature, and at the same time be waterproof. All of the substances used as insulation in making waterproof cables are organic compounds which either melt or become soft at a high temperature, in which case they both deteriorate as insulators, and run and drip off the wires as well, or they become charred or burned, and thus lose their insulating properties, and crumble or drop off the wires. In order to avoid all of these materials, which are rendered useless by the heat met with, we decided to inquire into the probable chances of a cable covered with some woven fabric, but left dry, that is, not treated with any fusible substance, such as wax or rubber, relying upon a lead-pipe covering to keep the water out. We found that precisely such a cable has been laid by the Metropolitan Telephone Company across Broadway at Ann street, where a high degree of heat was met; but unfortunately this has not been put in use yet, and we were not able to get its results. The telegraph company laid a similar cable about two years ago, which gave out, but the cotton had been treated with some substance, which may have impaired it, and the lead covering was injured enough to admit water. These were the only two cases we could find of effort having been made to make cables which would stand this heat, but unfortunately neither is a criterion. The remedy is unquestionably with the Steam Heating Company in stopping the leaks. The problem of making a cable to stand the heat is one of great difficulty and uncertainty as to the results, if it is possible at all. The heat caused by the steam leakage on Broadway was so great at the time the cable spoken of was laid two years ago that it expanded the brass pneumatic dispatch tubes of the Western Union Company, and crushed their ends against the brick junction boxes. A lead covering for cables will carry off some of the heat at first, and in some cases where the heating is temporary or local such a covering will be sufficient protection." A communication from the telephone company also showed that tests of the new cables parallel to the steam pipes had been seriously

injured by the heat, it being imposible to preserve the insulation.

On the question being asked "What efforts are being made by the Steam Heating Company to abate the nuisance," Commissioner Gibbens said: "The question is not what they are doing; the question for the consideration of this Board is the stoppage of the nuisance. It is inimical to the interests of property holders and the public, and it must be stopped." After further discussion, an application was presented from the Western Union Company for permission to stretch 250 wires in five cables overhead, as the subways were virtually untenable for the purposes of their business. Commissioner Gibbens said that the matter for consideration by the Board was whether the Western Union Company really needed these wires, for if so they must have them, and be called upon Mr. Brown, the representative of the company, to give the board information on the subject.

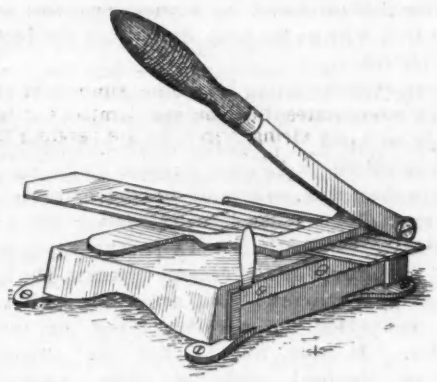
Mr. Brown said that the cost of the cables would be somewhere about $5 a foot, and the best proof that they were required was that the company were willing to go to such expense. The cables would all be put in immediate use. In reply to a question of Commissioner Hess, Mr. Brown stated that steps were being taken by the Western Union Company to place the wires underground between Fourteenth and Thirtieth streets. In the course of the discussion, Commissioner Gibbens expressed his reluctance to vote for any permit under the present conditions, and said, "It is the intention of the Board to have the subways occupied, as soon as they are fit for occupancy." The matter was postponed to the next meeting.

A Dynamo Brush Trimmer.

The trimming of the brushes for a dynamo or motor is, perhaps, a small detail in the work of a central station or power plant, but it is one upon which much of the smooth and successful running of the machines depends. In order to furnish a handy tool with which to keep brushes in order, Mr. G. W. Phillips, the superintendent of the Norwich, Conn., Electric Light Company, has devised the brush trimmer of which we give an illustation on this page. It is simplicity itself, and does the trimming thoroughly and effectually.

The New Ca·d Electric Motor.

About one year ago the Geo. F. Card Manufacturing Company, of Cincinnati, O., placed their first constant current electric motor in active service, and since that



A DYNAMO BRUSH TRIMMER.

time they have been engaged in making such changes and improvements as experience has shown to be necessary, and which are embodied in the machine illustrated in the accompanying engraving. The magnetic field in this machine, it will be noted, is generated by two sets of consequent pole magnets placed at right angles to each other.

A method of speed regulation for these motors has been adopted by Mr. Card, which is very simple. It consists in the use of a differential coil of low resistance in shunt relation to the series magnetizing coil, and a centrifugal governor driven from the armature shaft by means of a rubber belt. One end of the differential loop terminates at the carbon point held securely in a bracket on the top of the motor, and movable on a line parallel with the governor shaft by means of a screw. The other end also terminates at a carbon point, which, with its holder, forms part of the governing mechanism. In starting the motor, this part of the governor is open and the current flows through the direct series coil, quickly increasing the speed until the two carbons are brought in contact. The current then divides, part flowing through the differential coil and part through the direct coil, the ampère turns in the former being sufficient to neutralize the effect of the latter and to demagnetize the field. The tendency is for the armature to stop; but the slightest reduction in speed acts to separate the carbons and to bring into full effect the current in the direct coil, which quickly pulls them together. As a matter of fact, the shunt coil is never completely open, the governing carbon keeping up a constant vibration.

The carbons are one inch in diameter, and by means of a thumb-screw the fixed carbon can be moved forward or backward to increase or diminish the fixed speed as desired. A contact point is provided, so that in case the governor belt should break or fly off, the arms will collapse and close the reverse coil, thus stopping the motor at once.

The commutator is of large diameter, and the segments are made of copper castings drop hammered to nearly one-half of their original thickness, making an exceedingly hard and tough bar, and mica is used as the separating insulation. The same size of commutator is used in the ½ and 1 h. p. motors, which have 48 segments each. The 2 h. p. is larger, and has 56 segments.

The armature is of the Gramme ring type, built up of charcoal iron rings well insulated and put together in a special manner which requires no rods or bolts to hold them in place. This is accomplished by means of a cast-ir n ring at each end of the core, which permits of its being fastened securely to the shaft by two spiders. The shaft is large in diameter and made of tool steel running

FIG. 1.—THE BRYANT SWITCH.

in adjustable bearings of phosphor bronze, and made interchangeable.

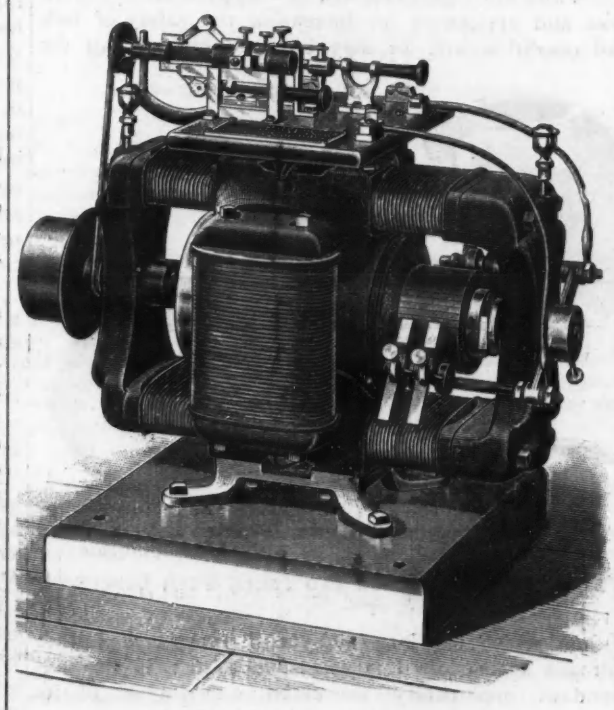
The terminals of the armature coils are brought out at the end opposite the commutator, and they are connected to the latter by means of large wires extending through the opening between the armature winding and the shaft. This provides an easy method of making connection with the commutator bars, and is convenient in taking the armature apart should necessity ever arise. A perfect running balance is obtained by means of an adjustable brass plate, which also serves as a protector to the coil terminals. These machines are built both for arc and incandescent circuits.

The Bryant Switch.

We illustrate this week a novel and what appears to be a very efficient switch or cut-out. It is the invention of Mr. W. C. Bryant, the electrician of the Bryant Electric Company, of Bridgeport, Conn. The switch is of the double pole "snap" variety, and is operated by a pull and push rather than by a swinging movement. In general, the switch consists of a movable circuit controling bar or contact piece, the whole movement of which is controlled by a power independent of the handle.

The function of the handle is simply to change the position of a pair of springs, so as to make their line of force coincide with the direction of movement of the circuit controling bar.

Referring to the illustrations, Figs. 1 and 2, the horizontal bar represents the circuit controling element. It



THE CARD MOTOR.

has an up and down movement to make and break connections between two pair of circuit terminals, located adjacent to each end of the bar. The handle or operating rod passes through an opening in the bar and reciprocates in a perforation through the base piece. The bar and rod are connected by two coiled springs, the points of connection with the bar being normally out of line with the connection on the rod. It will be readily seen that by forcing the rod down or in, the springs will be compressed by reason of the shortening of the distances between the points of connection on the bar and rod, and when the connection on the rod passes below the connection on the bar, the power which has been stored in the springs will be exerted to force the bar in an upward direction by a quick movement. The broken lines indicate the upper position of the bar. By withdrawing the rod the same movement takes place, but in the opposite direction. The small number of parts and the simple movements of this switch seem likely to merit the approbation of those who give it a trial.

Westinghouse Station and Stage Apparatus.

Among the apparatus employed in the Westinghouse central station which lack of space prevented our describing in detail in our last issue, is the ammeter which was shown in the switchboard cut. This measures the current output of the dynamo and is very simple in construction. In this ammeter, the current is made to pass through a solenoid consisting of a broad band of copper, the centre of which is a core made up of soft wrought iron wires. The motion of the core is opposed by a spring, and the movement is registered by a pointer passing over the dial. Another interesting piece of apparatus used in connection with the Westinghouse alternating system is the stage regulator for theatres, the object of which is to reduce or increase the brilliancy of the stage lights according to the requirements of the play. The apparatus, for this purpose, is in the form of a coil, which can be placed in the main circuit and which acts as a choking coil, the counter electromotive force of the coil acting as a resistance but not consuming energy. The regulation is effected by means of a handle, which can be pulled in and out, and when drawn out to its full extent dims the lamp to a dull red. When pushed full in, a plug at the right of the coil is forced between the contacts, thus cutting out the coil completely and bringing the lamps to their full brilliancy.

Military Telegraphy in Belgium.

An official report has been issued on the subject of the Belgium military telegraphic corps, from which it appears that Belgium has a standing army of nearly 50,000 men, not including the Garde Civique, which numbers 31,000. The total strength of the telegraphic corps on a war footing amounts to 4 officers and 210 men, and these are split

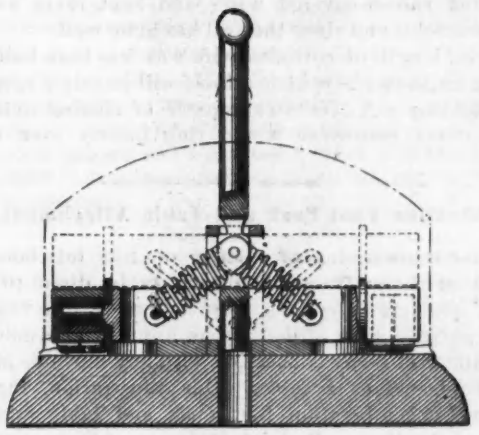


FIG. 2.—THE BRYANT SWITCH.

into two divisions. The first is devoted to the construction, taking up, and destruction of telegraph lines, and also attends to signaling in genera.; the second division is charged with the working, repairing, etc., of lines under the control of the military authorities. The *personnel* of the corps is divided into three sections: The first section is furnished with a wagon carrying 200 telegraph poles, spare stores and tools for putting up the wires; the second has a wagon containing 15 miles of wire wound on drums, and insulators, etc.; the third section comprises three wagons carrying 12½ miles of cable and 3¾ miles of special light wire for advance posts, in addition to the tools necessary for the construction of the cable lines; and it also carries necessary material for the installation of various workshops, and for this purpose a traveling workshop and a portable forge are provided. The corps is provided with 17 six-horse telegraph carriages, 15 of which carry either 45 miles of wire or 42 miles of insulated cable.

Telpherage Systems.

To the Editor of The Electrical World:

SIR: Our attention has been called to an article in a late issue of your paper describing a system of electrical transport, a so-called invention of Mr. Sprague.

We would beg to point out that "telpherage" is fully covered by certain patents of Professors Fleeming Jenkin, Ayrton and Perry, that we are sole licensees in the United Kingdom under these patents and are at present representing the holders of the patents in the United States and other countries.

We are authorized to state that the holder of these patents, in the event of infringement, will do all that is requisite to maintain these patents and stop infringers.

THE UNITED ELECTRICAL ENGINEERING CO., Ltd.,
MANVILLE & MADGEN,
LONDON, Oct. 19. Managing Directors.

[The system referred to above is the Chandler, which the Sprague Company has, we believe, adopted, and which is protected by United States patents.—EDS. E. W.]

An Experience with Electric Gas-Lighting Circuits.

BY CHAS. MONROE DOTEN.

In the last issue of THE ELECTRICAL WORLD I noticed "A Subscriber's" communication, and having had a puzzling ground on a gas-lighting circuit myself, I offer my experience.

The house was a new one, and the wiring had been done by an amateur who used double-wound and paraffined office wire throughout. About three months after the system was installed the lighters failed, and I found the zincs of the battery much wasted, more so than they would be in a year's run. This time I found that a servant who objected to the wire protruding from the wall where no gas bracket had been screwed on, had wound the uninsulated end of the wire around the cap on the end of the gas pipe. Everything ran all right for a short time, but within a week the apparatus again failed. A galvanometer test failed to show any leakage, but a subsequent test with a magneto generator similar to those used on electric lighting tests showed a finely developed ground. The whole house was wired on one circuit, and it took a good deal of patient work to test it out; but I eventually found the trouble in the cellar within a foot of the battery, which stood on a dry shelf.

One terminal grounded, of course, on the gas pipe, and the other went to line. The "artist" had poked the wire through a hole in a board nailed against the brick wall, then ran it up behind the board to another above it, where all of the other various bell circuits were arranged and labeled. The wire touched the bricks in one small spot. The bricks were below the surface of the ground, and absorbed moisture, which dissolved and brought to the surface the white salt so often seen on new bricks. This penetrated the insulation and corroded the copper wire considerably, the resulting salt being moist and spreading over considerable surface on the brick, but offering a high resistance and affording a path which allowed the battery to be constantly at work, the resistance being so great as to prevent the battery, a disque Leclanché, from becoming polarized to any great extent. I substituted rubber-covered wires and kept them away from the bricks, and since then all has gone well.

The total length of corroded wire was less than half an inch, which shows how little a fault will impair a system of gas lighting. A generator capable of ringing well on a 7,000 ohms resistance would ring faintly over this fault.

Combination Foot Push and Table Attachment.

With the introduction of electric circuits into houses, the addition of one from the dining table direct to the servants' quarters is coming more and more into vogue. For this purpose, floor push buttons are very convenient, as they allow of ready connection with any movable piece of furniture, such as a table. Our illustration, Fig. 1, shows such a combination foot push and table attachment made by Messrs. Partrick & Carter, of Philadelphia. As will be seen, the floor push can be used either alone or in combination with the extension attachment. When it is used alone, the pressure of the foot pushes down the plug and makes the connection between the two spring contacts, thus closing the circuit and sounding the bell. When it is desired to bring the circuit up to the table itself, the plug attachment shown in Fig. 1 is employed with the flexible cords that connect with the clamp and finger push shown in Fig. 2. The pressure on the button then closes the circuit in the usual way. The foot-push is very easily attached, and the clamp can be placed either above or below the table, and conveniently moved from one position to another.

Another Electrical Fish.

While I was fishing for cod the other day off Walmer, writes W. H. Copfield in *Nature*, I took up in my hand a small whiting pout that was flopping about in the bottom of the boat, when I received what appeared to me a slight though distinct electric shock in the palm of my hand, which made me exclaim at once, "that fish has given me an electric shock." On asking the fisherman (70 years of age) if he had known of such a thing occurring before, he said that he had "heard tell of it," and on inquiring further I found that he was referring to whiting pout and not to any other fish. He had never, however, noticed anything of the kind himself.

A Portable Installation for Cologne.

A carriage has been constructed for the town of Cologne on the plans of Mr. Hegener, director of the water and gas service, fitted with apparatus for the production of the electric light. This carriage is intended for the lighting of night work, for lighting the streets in case of accident, and, in fact, in all cases where a powerful light is required on any emergency, as is often the case in large towns. The carriage is fitted with a boiler, dynamo, 400 yards of conducting wire and four arc lamps fitted with posts. There is also a high candle-power incandescent lamp for carrying about where an arc lamp could not be used. On arrival at the place required the posts are fixed upon the ground, the lamps are suspended and the current is turned on—an operation only requiring a few minutes to perform. This portable installation has been constructed by the assistance of the Helios Company at a cost of $3,500, inclusive.

Distant Signals for Railroads.

Mr. George W. Blodgett, the well-known electrician of the Boston & Albany Railroad, has the following remarks on the Mud Run disaster, in the *Railroad Gazette*:

Ignorance of the law cannot be pleaded in a court of justice as a bar to the punishment of violations thereof, nor does it in any way diminish the gravity of the offense—indeed, it may even aggravate it in some

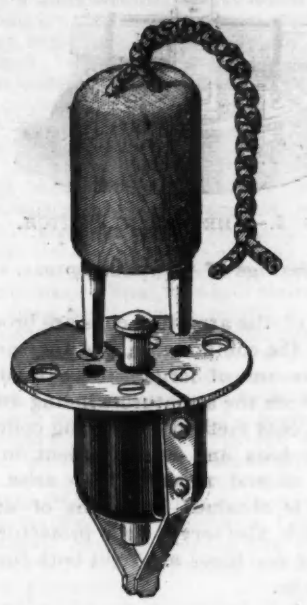


FIG. 1.—A NEW FLOOR AND TABLE PUSH BUTTON.

cases—unless it can be shown that the guilty party has diligently used all the means in his power to ascertain what he ought to do, but without avail. Public sentiment will usually sustain the view that a man has no right to do what may put himself or others in jeopardy, without first finding out whether the proposed action may safely be taken. We carry this reasoning into the physical world, and demand that men who use its forces shall know the laws which govern them, and that they to whom the transportation of human lives is intrusted shall know how to guard them safely. May we not judge the management of a business by this principle, and apply the same reasoning to the Mud Run accident?

The Lehigh Valley road is located in a central and thickly settled region. It has abundant resources and skilled and intelligent officials, to whom the most modern ideas and appliances for increasing the safety of railroad operation are, or may be, well known; all the

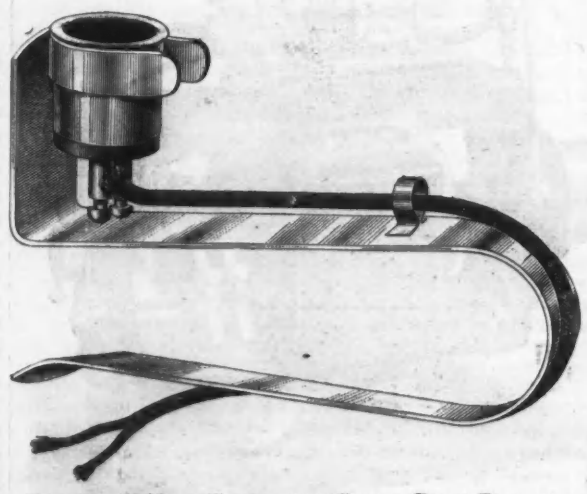


FIG. 2.—A NEW FLOOR AND TABLE PUSH BUTTON.

wisdom which the large and varied experience of other railroads has acquired is accessible to it; it also has abundant opportunity to make experiments of its own. May we not, then, fairly hold the management of this road responsible for the consequences if they have neglected to use in a place like that, where this accident occurred, any device of reasonable cost, which may prevent such a catastrophe? There are such devices; they have been in use for many years, on railroads doing a large freight and passenger business, and it has been shown beyond a reasonable doubt that when officials do not (as you say of the block system) "expect impossible things," they add very materially to the safety of trains. I refer to automatic signals. Here was a place and a set of circumstances where, if anywhere in the world, intelligent prudence would dictate their use. A station hidden from view of approaching trains until they are close upon it; a signal which is relied upon to hold back trains from coming to (going beyond) the station, located, not where it ought to be, at a distance sufficient to admit of stopping a fast train before reaching the station, should the signal show danger, but at or near the end of the station platform (as a matter of fact this signal was not used at all on this occasion); trainmen, some of whom, at least, appear to have been unfamiliar with the duties they were selected to do, and not in the physical condition in which they should have been to do the best work of which they were capable, and running under orders not so explicit as to leave no room for doubt or misinterpretation, Is it a matter for surprise that an accident resulted? Yet it might have been very easily prevented. Less than $500 would have provided an automatic signal at a safe distance from the station, and less than $100 would maintain it for a year. How many such might have been put up and kept in order for the sum this accident will cost, to say nothing of the fearful loss of life? Have the officials of this road any ground on which to stand in explanation of the reason why they have not adopted something of the kind? These are not new and untried devices. A large number of roads have them in use, and some have equipped their whole line. They are not intended as a substitute for watchfulness and vigilance, but they are a valuable addition to these safeguards in the operation of a railroad. The great expense of the block system is often urged as a reason for its not being more generally adopted, and this argument is doubtless often sound; but no road running many passenger (or even freight) trains can afford to take the risk of such an accident as this, when the road may be made so much safer at so small an expense. It is easy to see now that the trainmen, or the operator, or some other person or persons, did not take proper precautions against accident; but while attempting to place the responsibility where it belongs, we should, I think, not lose sight of the fact that the failure to provide automatic protection for this station was a remote cause of the disaster. It is most fervently to be wished that the lesson may not go unheeded.

Heating by Electricity.

BY ELIAS E. RIES.

THE ELECTRICAL WORLD of Oct. 13 contains a short article on the above subject, in which the writer, after dwelling upon the relative merits and advantages of electric heat over that produced by stoves, proposes to use coils of flat iron wire as the heat developing conductor in an electric circuit.

I have been experimenting for some time past upon a system of electric heating forming the subject of patents issued to me on April 24, 1888, in which low tension currents of large volume were sent through radiating plates made of thin sheet iron, so arranged and constructed as to expose an exceedingly large heating surface for a given sectional area or conductivity. These experiments were made both with direct and alternate currents, the radiating plates being corrugated and arranged so that they could be connected in parallel, series or multiple series order. It was found that the amount of useful heat obtained with a given expenditure of electrical energy was not only much greater than when ordinary coils of iron, German silver and platinum wire, respectively, were used, but that the heaters, when connected in parallel order, were also entirely self regulating, and capable of maintaining a constant and uniform temperature in their respective apartments under wide variations in exposure.

The radiating plates employed in these heaters cost but a few cents each, and readily lend themselves to any desired form of mounting and ornamentation. They are, of course, never raised to incandescence, and are consequently entirely free from fire risk and from the deterioration to which other heat-translating devices are subject. The heaters used in most of these experiments were designed especially for use in connection with alternating current circuits, a suitable transformer being provided for reducing the potential and increasing the volume of the current to that required by the heaters. Very good results were attained by this method both with a direct and indirect conversion of the current, and I have succeeded in successfully obtaining both heat and light upon a commercially operative scale from the same supply circuit. Although experiments with this system are still in progress, the results so far achieved seem to justify the prediction that it will not be very long before electric heating will draw very largely upon the supply of current furnished from central stations, not merely to a great extent for ordinary heating purposes, but for numerous other domestic, culinary, manufacturing and industrial applications.

In the article referred to the advantages possessed by electricity over the ordinary stove for heating, cooking, baking, etc., were very concisely set forth, but perhaps its greatest advantage from a commercial standpoint lies in the fact that the self-same current that is utilized in this system for heating will be also used for electric lighting and power distribution, and the current generated for all of these purposes may be transmitted to the various points of consumption over the same circuit. Instead of numerous small and wasteful units, such as those represented by individual furnaces and stoves, a single large generating station equipped with the most modern appliances for the economical production of electrical energy,

such as improved boilers, furnaces and triple or quadruple expansion compound engines constantly working at full capacity would be sufficient to supply an entire district with all the heat that may be required, to say nothing of light and power, at a cost to the consumer that will compare favorably with what he is now called upon to pay for the fuel, attendance, etc., required by the present crude and wasteful methods of heating employed by him.

Of course, so long as we must rely upon the intermediate boiler, steam engine and dynamo for converting the latent energy of coal into electricity, we cannot expect, from a theoretical standpoint, to obtain any very great economy in electric heating over the ordinary process of heating by the direct combustion of coal. Practically speaking, however, the economy and advantages are both in favor of electric heating from central stations, even at the present time. Not only do stoves waste fully three-fourths of the energy of the coal consumed by them, but this coal must necessarily be of good quality and cost the consumer two or three times more per ton than that paid by nearly all large electric light stations for a cheaper grade of coal answering the same purpose. The use of compound condensing engines will save a considerable portion of the energy that is now wasted in many generating stations. By employing high tension alternating currents and well insulated underground conductors the current generated can be transmitted at a very slight loss throughout the district served, and as before stated, converted at will into heat, light and power. The large increase in the size and earning capacity of these stations, due to the vastness of the field to be occupied by electric heating, will also contribute very largely to a still further reduction in the cost of current. From the foregoing it will be seen that, with the encouraging progress already made in the direction of providing a more efficient and satisfactory method of utilizing the current so as to obtain the greatest possible amount of heat therefrom, the problem of successfully heating by electricity is practically solved, and I hope soon to have the system so perfected as to warrant its early introduction.

Vortex Analogue of Static Electricity.*

BY PROF. W. M. HICKS, F.R.S.

Consider two bodies touching one another placed in an infinite fluid, and with a vortex filament, the ends of which are one on one surface, the other on the other. If now the surfaces be separated from one another, there will be formed at the point where they separate a hollow vortex filament stretching from one to the other, with rotation equal and opposite to that of the original filament. As the bodies are moved apart these filaments will not, in general, take up a position of rest. If the strength of the original filament be very great, or if there be several of them, the resulting hollow vortex will, through instability, split up into a number of smaller ones. If the resulting number be very large, they will ultimately take up some position of stable equilibrium. What the distribution in this will be I cannot say, but the following is one state of equilibrium, and, probably, although I have not proved it, a stable one. The two sets of filaments will be mixed up with one another, and each will distribute itself according to the same law as the distribution of lines of force between the two bodies supposed equally and oppositely electrified.

In the case of the original filament, as the surfaces are further and further separated, their sections become smaller and smaller. This is, however, not the case with the hollow filaments. Their section depends only on the pressure of the fluid and their circulation, and as these remain constant, the areas of their section also remain so. In such a hollow vortex the pressure inside sinks to zero. Consequently the portion of the surface on which it abuts experiences a diminution of pressure, a diminution which is the same at all distances. The two bodies are therefore attracted towards one another. Moreover, as the two bodies separate further, the distribution of the filaments being the same as that of electrical lines of force, and the diminution of pressure for each line being constant, it follows that the force between the two bodies follows precisely the same laws as the force between the two bodies supposed equally and oppositely electrified.

If another surface be brought into the presence of the others, some of the filaments would abut on this. These would break off, rearrange themselves so that some of the filaments would end on it, and an equal number start from it. Call those ends of the filaments positive at which the rotation, looked at *from* the surface on which they abut, is right handed; and those ends negative at which the rotation is left handed. The two ends of any filament will then always be of opposite name.

The analogy with electrical action is then close. Two bodies, A, B, brought in contact touch in innumerable points. Owing, possibly, to the different states of motion of the ether at their surfaces, a state of equilibrium is set up, consisting of a kind of sifting or vortex motion, already subsisting, so that, on the whole, more lines go from A to B than *vice versa*. This is E.M.F. of contact. Separate the bodies, one has a number of positive ends of hollow filaments, and the other an equal number of negative ends. *The bodies are equally and oppositely electrified.* The force, in its hydro-dynamical case and in its electrical analogue, follow the same laws. Bring into the field another surface C. The filaments rearrange themselves as mentioned above, the negative and positive ends abutting on C being equal. *This is induced electricity.* If the surface C consists of a large number of small unconnected surfaces, the filaments will arrange themselves in some manner depending on the sizes and distances of the unconnected parts, the field will be disturbed in a similar way to that in an electric field into which a dieletric is placed. This is the analogue of electric strain in a dielectric. So far, the ground is fully safe; the succeeding remarks must be regarded as speculation.

Returning to the case of the two separated surfaces A and B, what will happen if they be connected by a third surface, say, to fix ideas, a long narrow cylinder or wire? It is not so easy to say certainly what the exact re-arrangement will be. It would seem very probable that the hollow filaments near the wire would at once be replaced by circulation round the wire. In this case the solid filaments must rotate as a whole round it, while, at the same time, although this has not been proved, they will contract their ends more along until they come together, form a ring, and get mixed up in the surrounding fluid. This would correspond to the *current of discharge.* But notice that if this is so, the fluid outside the wire rotates round the wire while a stationary state is being reached, and as we know that the field round a current is a magnetic field, it follows that the *analogue of a magnetic field is a flow along the magnetic lines of force.* It may, however, be further necessary that these streams must contain vortex filaments moving with the fluid, their axes at every point being perpendicular to the lines of force there.

If the field is determined by the flow of fluid independently of the vortex motion, it is not easy to see the hydro-dynamical analogue of the induction of currents, when, say, a wire moves across a uniform magnetic field. If, however, the vortex filaments, as above, are a necessary adjunct, it is conceivable how a movement of the wire across the lines of flow and amongst the filaments produce an instantaneous disarrangement, which will travel through the vortical fluid with the velocity of propagation of transverse vibrations in a vortical fluid. That is in the ether, as Sir W. Thomson has shown, with the velocity of light.

It is difficult to see any analogue to the rotation of the plane of polarization of light by a magnetic field.

* Read before the British Association.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, Nov. 3, 1888.

The American Leather Link Belting Company,

of this city, was incorporated on Oct. 10. The officers are Charles A. Schieren, president; E. L. Burrell, secretary; F. A. Burrell, treasurer, and H. Bramm, superintendent. The object of the company is to manufacture and sell leather link belt made from the best oak tanned leather, especially for electric lighting.

The National Electric Manufacturing Company

is a new concern recently started at Eau Claire, Wis., with the object chiefly of introducing a transformer system of incandescent lighting Mr. H. H. Hayden is the president, Mr. Fitch Gilbert, vice-president; Mr. R. E Rust, secretary, and Mr. E. B. Putnam, treasurer. The electrician is Mr. Walter K. Freeman, whom I met around town this week. He is east securing supplies, &c.

A Dust Proof Bell.

The enterprising firm of Hazazer & Stanley, of Frankfort street, have just brought out what they call the "H. & S." dust proof bell. One of the leading improvements in the bell is the doing away with the back plate, and fastening the spools of the magnets to the frame of the bell itself. The armature is also finely pivoted, with back adjustment, in place of being solidly attached to the back. The armature is moreover copper plated instead of plain iron to avoid "sticking," and will not rust. The bell also has an adjustable back or cover for the works, so as to exclude dust, plaster, insects, etc.

I regret to make note of the following from the *Times* of today: "Edwards H. Goff, until recently publisher of the *Daily Graphic* at 39 Park place, made an assignment yesterday to Thomas H. Bullick, a lawyer, at 120 Broadway. Mr. Bullick said that the assignment was the result of Mr. Goff's desire to protect his equities in certain stocks and bonds which he had put up as collateral to secure his individual indorsement in connection with his business as publisher of the *Daily Graphic*. Mr Goff is well known in this city and elewhere for his connection with various enterprises. In November, 1887, he became interested in the American *Graphic* Company, and was its president. He indorsed notes for the company, and several judgments have been entered against him in connection therewith. A few days ago the *Graphic's* property was sold at sheriff's sale, and the control passed into other hands."

Platinum and Platina Wire.

I had the pleasure of meeting last week Mr. H. M. Raynor, of 25 Bond street, the importer and manufacturer of platina wire, crucibles, and other specialties of that class. Mr. Raynor is, I believe, the oldest in his field, and is naturally fully conversant with the production of platinum, etc. He tells me that the syndicate, now controlling the product in Europe, has raised the price 10 per cent. on account of the large importations to the United States, which have grown to a very considerable figure at the present time. The demand practically exceeds the production, and there is a good chance for ingenuity to provide a substitute.

The Julien Electric Company.

The Julien Electric Company have just closed a contract with the Hartford Electric Light Company, of Hartford, Conn., for 500 of their large type of accumulators, with which they are to supplement the present system, which comprises 600 arc and nearly 3,000 incandescent lights. It is the intention of the company to enlarge their accumulator plant later so as to supply about 2,000 lights. The Hartford Electric Light Company has one of the largest distributing plants in New England, and the introduction of the Julien battery by them, after a thorough investigation of over a year, is a fair indication of the merits of that battery, and goes to show that the accumulator has entered the field of central station lighting as a factor in the reduction of the cost of electric light, as against the old method of producing light direct from the dynamos. The battery is connected on to the light mains, and any surplus current there may be at any time is accumulated and stored up for future use. In this way the machinery in the station is always running at the full capacity, and consequently obtaining the greatest possible return for the fuel expended. The station can, in addition, be run the entire twenty-four hours, and as the average incandescent lighting is for a period of but four out of the twenty-four hours, a direct lighting plant can be made to produce, when supplemented by accumulators, from 35 to 40 lights to the mechanical horse-power installed. Although the revenue from a plant installed in this way is increased manifold, the operating expenses are not very materially increased. The Julien Company reports that inquiries from central station companies are becoming daily more frequent, and before long they expect to have a number of central station plants in active operation. In addition to the plant above referred to, the Julien Company have also sold very recently for street car purposes some 700 cells, and have also obtained the contract for installing an accumulator plant in the Brooks Locomotive Works, Dunkirk, N. Y.

W. T. H.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., Oct. 27, 1888.

The Edison Central Station.

The Edison Company are making rapid headway with their new central station at Ninth and Sansom streets, and have their underground system about completed, so that as soon as the building is equipped with the necessary plant there will be but a short delay in supplying lights to a large number of anxiously waiting customers.

Electric Light Plants.

The Novelty Electric Company have installed a 75 arc light, 2,000 c. p. double lamp plant at Wilmington, Del., for the Wilmington Electric Light Company, which is the second plant of this size furnished by this company of the Ball system. The Novelty Company have also put in a 25-light divided arc Ball plant, of 800 c. p. each, which they operate with eight horse-power, and they have in view a plant of the same pattern of 70 lights, to be run with 21 h. p.

Feed-Water Heaters for Electric Light Plants.

Warren, Webster & Co., of 491 North Third street, are certainly not lacking for testimonials as to the efficacy of their feed-water heater and purifier. Quite recently they have received from the Abram Cox Stove Company and the Edison Illuminating Company, of Lancaster. Pa., specimens of a sediment composed of lime and magnesia, which was caught by their purifying machine, which, if allowed to enter the boiler, would have caused serious damage. These specimens, as seen when hardened, range from ½ to 1 inch in thickness and demonstrate quite thoroughly the value of the Webster feed water heater and purifier. The Webster Company have now received patents, not only for the mechanism of their machine, but for the process, as well, which covers the process of converting water into vapor and reconverting the vapor back into water. The patents now held cover both the mechanism and the process in this and all the leading foreign countries. The Pencoyd Iron Works have given an order for two 1,000 h. p. Webster machines, which is a duplicate of a former order.

Electric Conduits.

The work of putting the wires underground is being pushed vigorously. The American Telephone and Telegraph Company, the Bell, Edison, Keystone, Penn E. L. Company, and the Underground E. L. and P. Company have all been at work through the last few months, and hundreds of permits have been obtained for making the openings. They have to pay $3 for each permit, which gives them the privilege of opening for 500 feet. The Bell Telephone Company has taken out permits to lay its conduits on Water, Second, Third, Fourth and Fifth streets, and several streets tributary between Vine and South streets; also, all the way out Market street. The other companies have not as yet laid any great number of conduits, with the exception of the Penn Company. It is said that the estimated cost of laying underground cables and subways is about nine times as great as the cost of stringing overhead wires.

A meeting of the sub-committee of the Electrical Committee of City Councils, to which was referred the application of the Keystone Light and Power Company to lay conduits upon certain streets, was held Wednesday. The attorney for the company stated that last year an application was made for the laying of conduits in addition to those named in a previous bill which was passed some time ago. The second application for additional privileges was not granted, and the company, believing it had the right to lay conduits under its charter without any action by councils, applied to the court to have an interpretation given to the charter, and to be given the authority to go on and lay the conduits. The court, however, stated that inasmuch as it had received privileges from councils, it had better make another application, and, in the event of a

refusal by councils, then the court would hear argument upon the charter and decide upon its merits. The committee then authorized the chair to submit the bill of the Keystone Light and Power Company to the City Solicitor, requesting him to examine the same and advise the committee whether it in any way conflicts with the chartered privileges of the company. Also, whether the city can enforce the provisions of the bill, and whether he can approve of it in the form submitted. If he cannot approve of it, to prepare another which will protect the city's interests without conflicting with the rights of the company.

E. W. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, Nov. 3, 1888.

W. D. Allen & Co.

have recently taken the Western agency for the New York Belting and Packing Company.

David City, Neb.

James Bell is putting in 30 arc lights and 300 incandescents of the compensator system of the Thomson-Houston make.

Ravenna, Ohio.

The Ravenna Gas Light and Coke Company are putting in a plant consisting of 35 arc lights, Thomson-Houston system.

Mason, Mich.

S. A. Paddock, of this city, has just purchased of the Western Department of the Thomson Houston Company 35 arc lights.

Kerite Wires.

Some large orders for Kerite wire and cables have been received during the past week by the Electrical Supply Company.

Marshalltown, Iowa.

The Marshalltown Electric Light Company has added to its arc light plant 1,000 incandescent lights of the Thomson-Houston compensator system.

Chicago Arc Light and Power Company.

The Chicago Arc Light and Power Company is constantly branching out and increasing its plant. At present it is adding 160 Thomson-Houston arc lights.

A New Electric Street Railway.

The Decatur (Ill.) Electric Street Railway Company, at Chicago, has been incorporated; capital stock, $100,000; incorporators, E. T. Martin, C. M. Barclay and F. Sargent.

Telephone Quotations.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.....	$150@	$155	Iowa Union.....	$28@	$29
Central Union.....	47@	48	Michigan.....	81@	82
Chicago.....	338@	340	Missouri and Kansas	70@	71
Colorado.....	43@	46	Rocky Mountain Bell	41@	43
Cumberland.....	68@	70	Wisconsin.....	116@	118
Great Southern.....	34@	37			

Council Bluffs & Omaha Electric Railway.

The formal opening of the new electric railway running between Council Bluffs and Omaha and the new bridge which spans the river at that point occurred Oct. 29. Reports from there show that the starting of the road was a complete success. The system is the Thomson-Houston, reference to which has previously been made in these columns. Some six trains, consisting of two and three cars each, were run back and forth between the two points constantly that day.

Chicago Electric Club.

A meeting of the Chicago Electric Club was held last Monday in the club parlors, President Barton in the chair. After the report of the treasurer had been received and other formal business had been attended to a very interesting and valuable paper was read by Mr. C. C. Haskins, entitled the "Universality of Vibrations." At the close of the reading remarks were made upon the same subject by Messrs. Leonard, Cutter and De Bausset and Mr. Kedzie, who was a visitor at the club.

New Incandescent Machines.

At the shops of the Van Depoele Electric Manufacturing Company this week I was shown patterns of the new Mayo incandescent machine of the Kapp type, which is being brought out by the company. This system, I learn, the company are nearly ready to commence the extensive manufacture of. The company have also in operation at their factory an incandescent machine, at present running twenty-five 16 c. p. lights, which is to be used for experimental purposes in the Northwestern University.

Honors for the Waterhouse System.

I learn from Mr. C. F. Dunderdale that the Waterhouse system has been awarded by the Centennial Exposition of Cincinnati one gold and two silver medals for superiority of apparatus, consisting of dynamos, regulators and lamps. The eight 30-light dynamos in operation there were run for 100 consecutive nights without interruption, and to the satisfaction of the management. These honors, in addition to those received at the Mechanics' Charitable Institute at Boston last winter, are highly complimentary to the excellence of the system.

A Handsome Catalogue.

I am in receipt of a new catalogue, consiting of some 90 pages, just issued by the Thomson-Houston Company, and descriptive of the electrical apparatus manufactured by that company for its different systems of arc and incandescent light and power transmission. The catalogue is very elaborate in its get-up, being handsomely engraved. Besides the cuts illustrating the apparatus, illustrations are given showing the factory of the company in 1882 and that at present occupied by the company. It also gives, in addition, a list of the cities and towns in which the Thomson-Houston system is in use, together with the names of the companies.

New Electrical System.

A little circular, descriptive of the Seafert electrical system of generating, transmitting and utilizing electrical energy, has just come to hand. Wm. Seafert & Co., of this city, are the proprietors. In the circular it is claimed that in this system the practical solution of the problems of electrical engineering in the department of electric light and the distribution of power is reached. The dynamo used is claimed to be practically reversible, and may be employed as a generator or motor, and the automatic regulation is dependent upon a new principle. Both arc and incandescent systems of lighting are used, besides the electrical transmission of power. In the transmission of power it is claimed that two or more motors can be operated in series, each motor being independent of the other. On account of the simplicity of the regulation of the motor, it is claimed to be especially adapted for street railway propulsion.

Leonard & Izard.

Messrs. Leonard & Izard, consulting and contracting electrical engineers, are branching out in various ways. Mr. W. S. Andrews, the well-known engineer, formerly with the Marr Construction Company, of Pittsburgh, has associated himself with this firm and will have charge of a branch office in Minneapolis. This branch will act as agents for the installation of isolated plants of the Edison system in Minneapolis and St. Paul, and do all the construction work for the local Edison companies in both these cities. The company are very busy at the present time in making new installations of the Edison light in their territory. Besides their electric light business, they are also doing considerable construction work for electric railways, making this the special branch of their business. In this they will not confine themselves to any particular railway system. At present they are building a road of the Sprague system at St. Joseph, Mo.

Baxter Motors.

I learn from Mr. W. W. Munroe, the Western manager of the Baxter Motor and Manufacturing Company, that the Duluth Electric Light and Power Company, of Duluth, Minn., through its president, Mr. John Patton, has arranged for the installation of Baxter motors to be operated from the station. A special power circuit with separate generator will be put in for the purpose of furnishing the current. It is expected to have the circuit in operation by Nov. 1. The Denver Electric Light Company, of Denver, Colo., are also putting in a power circuit on which they will operate Baxter motors, and which it is expected will soon be running. One day this week I saw a one horse-power Baxter incandescent motor operated from an Edison circuit and running a printing press. It was running very nicely. I may also add that this is the first of their incandescent motors in use in Chicago, but Mr. Munroe informs me it will be speedily followed by others.

The Electric Shock.

The Sunday *Herald* publishes an interesting interview with Mr. George A. Mayo, the electrician of the Van Depoele Company, on the subject of electric shocks. Mr. Mayo, it will doubtless be remembered by many, received a shock of 3,200 volts some two years ago while acting as electrician of the Narragansett Electric Light Company, of Providence, R. I. This, it is claimed, is the heaviest shock of electricity that a human being ever survived. Mr. Mayo was thrown on a fifty arc light dynamo, and received the full force of the current. His sensation on first receiving the shock, he states, was not at all unpleasant, and there was absolutely no pain, it instantly destroying all feeling except the roaring in the ears, and he compares the effect upon the system with that of laughing gas. He thinks he retained consciousness for perhaps 30 seconds. The treatment used to restore him to consciousness was the use of several buckets full of water, and hard rubbing. His hands were terribly burned, but aside from that he received no permanent injury, save that he thinks his nervous system never quite recovered from the shock. Mr. Mayo is hardly in favor of the law in the State of New York requiring the infliction of the death penalty by means of electricity, inasmuch as it has not, so far, been practically demonstrated how large a shock is necessary to kill absolutely and under all circumstances without a hope of resuscitation.

St. Louis Items.

The Heisler Electric Light Company, of St. Louis, report as follows:

"Our general agent, Mr. J. Geo. Kaelber, has sent in another very large order for a central station plant at Buena Vista, Col. Poles are now being set up, and the plant will be completed and in working order by December. The station will combine street and commercial lighting, on a circuit of eight miles. The dynamo will be run by water power located about a mile outside of the city. The Pueblo Gas Company has already been reported as having purchased a very large plant of 2,000 lights, but we can state that the dynamos have all been sent and the plant is now under erection. The same will be in operation inside of a few weeks, including street, commercial and private house lighting. There will be about 15 miles of line wire circuits. The electrical plant will be located at the gas works, a railroad switch being connected with said works so as to deliver the coal in front of the boiler. The Armington & Sims and Ball engines are being used. The Pueblo Company have decided in favor of the Heisler system, after having thoroughly examined all the existing methods of long-distance incandescent work. The Heisler Electric Light Company has also received an order for a central station plant in Michigan City, Ind., which will be completed and in running order before Christmas. There is another 500-lighter being shipped to-day from our works, making the third machine for our Matteawan station on the Hudson, in New York State."

E. L. P.

SOUTHERN NOTES.

FORT WORTH, Tex., Oct. 25, 1888.

The plant of the Fort Worth Electric Light, Heating and Power Company on the Westinghouse alternating system, constructed under the supervision of Mr. Norman Marshall, of the F. S. Marr Company, began operations Oct. 8 with about 2,000 incandescents and 60 arcs in circuit.

The station building, at the foot of Macon street, is a massive brick structure, a model of neatness and convenience—109 × 45 feet with fire proof trussed roof. The equipment consists (in addition to the arc light machine and engine moved from the old works) of three 15 × 11½ inch Beck engines belted direct to the same number of Westinghouse alternating dynamos. Four steel boilers 60 inches by 14 feet are set in one battery, with a space reserved for two more of the same size. A 300 h. p. heater, two pumps and an injector go to make up the steam plant. Water is obtained in abundance from an artesian well 840 feet deep by 10 inches diameter, situated a few feet from the station building. Coal is delivered from a side track to the building. At present an office and storeroom are partitioned off from the front part of the engine room, but as business increases the space will be occupied by additional machinery. Current is distributed to different parts of the city by six separate feeders, averaging over a mile each in length, and with the mains aggregating over twenty miles of single wire. The switch-board is arranged so that any feeder may be changed from one dynamo to another without interfering with the lights.

So far everything in connection with the installation, which, by the way, is the largest in Texas, with the exception of the Westinghouse plants at Austin and Galveston, has proven eminently satisfactory, so that the company are obliged to use every effort with a large force of wiremen to keep up with new orders. Situated as Fort Worth is, in a rich and healthful agricultural country, with eleven railroads radiating in all directions, the outlook for electric lighting and power business seems very bright; in fact, all business is brisk and getting better.

At Gainesville, Tex., the Electric Light Company have sold out to the gas company. The latter concern have erected a new brick building near the gas works, where they will place a 650-light Westinghouse incandescent machine, and two 35-light Thomson-Houston arcs, disposing in some way of the old arc lighting apparatus acquired from the light company. The Marr Company are doing the construction.

At Orange, Tex., the Marr Company have just completed a small isolated plant of 300 lights (Westinghouse direct current system) for Lutcher & Moore.

ENGLISH NOTES.

LONDON, Oct. 24, 1888.

The Revival of Electric Lighting.

There can be no reasonable doubt that the long predicted revival of electric lighting is at present actually in progress. The London Electric Supply Corporation which, as you already know, has been doing good work for some time past, will shortly open its new central lighting station at Deptford, and the whole of London between Kensington and the Monument will then have the electric light within its reach. This station will be the largest in the world. It is proposed to start with a couple of 2,000 h. p. and two 10,000 h. p. engines and space has been reserved for another pair of 10,000 h. p. engines. Even this large order does not seem to satisfy the directors of the company, for sufficient ground has been purchased to enable them to double their plant. The engines and dynamos which are to be at first laid down will be equal to supplying 600,000 incandescents, and if the ambitious projects of the board are will have a capacity of over 2,000,000 lights. The dynamos will carried out in their entirety, the Deptford central lighting station be of the Ferranti pattern, with 40-foot armatures. It is perhaps needless to say that the current will be distributed on the transformer system. Perhaps the smartest feature of the programme is the clever way in which the three southern railways have been induced to lend their help to the scheme. The mains will be run along the railway lines from Deptford to the four southern termini, Cannon street, Ludgate Hill, Charing Cross and Victoria, and will radiate thence in all directions. In addition to this the District railway have also entered into the combination, and their tunnels will afford a large ready-made subway for an indefinite number of conductors. The station at Deptford is very easy of access by rail and abuts on the river, so that there is every facility for the landing of fuel and heavy machinery. With the large experience they have already had, and backed as they are by capital and intelligence, it will certainly be surprising if the London Electric Supply Corporation should fail to succeed, although I think the 2,000,000 lights are as yet far from being within the range of "practical politics." However, be the outcome of this gigantic enterprise what it may, we shall at last feel the satisfaction of having the biggest central station on the face of the earth, as even Yankee energy has not up to the present given birth to a two-million light station.

Electric Light Plant for the Suez Canal.

As most of your readers are doubtless aware, the employment of the electric light to enable vessels to pass though the Suez Canal at night has become very general. No less than 43 per cent. of the total traffic is now conducted in this way, thus economically and effectively increasing the carrying capacity of the canal by this amount. The saving of time effected is also a great feature of the introduction of the electric light for night navigation. Vessels using electric light pass from end to end within twenty hours, as a rule, while those without rarely succeed in doing so under double this time. The employment of the light has indeed become so general that several of the prominent coaling firms at Port Said derive a profitable trade in letting out sets of portable plant for use during the passage of the canal, an average charge of £10 being made. Messrs. Charlesworth & Co., of Oldham, have lately designed a complete set of apparatus especially adapted for this kind of work. The regulations issued by the Suez Canal Company in February, 1887, require that all ships passing the canal by night should be provided with "an electric search light throwing a beam 1,200 metres, this search light to be placed as close to the waterline as possible," and also with "an electric lamp and reflector suspended above the bridge capable of lighting a circular area of about 200 metres diameter." In the plant designed by Messrs. Charlesworth & Co., therefore, the dynamo and engine are carried upon the same bedplate, and in order to protect them from injury when being shipped and unshipped, they are inclosed in a strong steel box, the sides of which can be removed when working; the engine is of the open frame type. On account of the slow speed at which the vessels proceed through the canal, steam is generally allowed to fall below the normal pressure; the engine has consequently been constructed to work at the low pressure of 40 pounds per square inch. On some vessels, however, this custom is not followed; pressures as high as 120 pounds being occasionally carried. A throttle-valve governor not work-

ing efficiently through such wide limits, hand expansion gear is fitted, capable of varying the cut-off from ¼ to ⅝ stroke. By this means, the engineer can set the cut-off to suit pressure, leaving a reasonable margin for the governor to deal with. The dynamo is compound-wound, giving 65 volts and 55 ampères at 425 revolutions per minute. The armature shaft is coupled direct to the engine shaft by means of a conical interchangeable coupling. The projector is of very strong construction, the barrel being of rolled cast steel. It is fitted with mirror and usual horizontal and vertical movements for directing the beam of light.

The Electric Haulage Plant at St. John's Colliery.

I have recently visited the St. John's Colliery, Normanton, where there is a very interesting instance of the electric transmission of power. I think that THE ELECTRICAL WORLD has already contained a description of the arrangements, and therefore I will not do more than briefly allude to the more important features. It is, however, worth while to again call attention to this plant because of the enormous field which undoubtedly exists all the world over for the utilization of electricity in mines. The water is lifted through a height of 900 feet, at the rate of 150 gallons per minute. Power is obtained from a Robey engine on the surface, which drives a dynamo giving 600 volts and about 60 ampères. The motor at the bottom of the mine runs at 450 revolutions per minute, and drives a pair of differential rams which run at 25 revolutions. This plant has now been in continuous use for nearly twelve months without any breakdown of any kind whatever. A large number of mine owners and others have, from time to time, visited the colliery, and have expressed themselves extremely gratified with the arrangements. Now that a sufficient proof of the durability of the plant has been given, the example of the St. John's colliery proprietors will undoubtedly be followed in many other instances.

The Cowles Aluminium Works.

I have also lately visited the works of the Cowles Aluminium and Electric Smelting Syndicate at Milton in Staffordshire. These were so fully described in a paper by Mr. Crompton, read at the recent meeting of the British Association, that I have very little to add. I would merely say that the concern is in full swing, and that it is already in contemplation to double the existing plant. Seeing that the process is in no sense electrolytic, I should not be surprised if eventually alternating current plant is substituted for the present arrangement. It is obvious that in dealing with currents of from 6,000 to 10,000 ampères a transformer plant can be handled with far greater facility than the direct current. I am, however, unable to learn that any experiments have as yet been made in this direction.

THE TELEGRAPH.

T. M. B. A.—Assessment No. 223 has been made to meet the death claims of W. H. Booth and D. Lovenstein.

Telegraph Maps.—The *Berne International* office has lately published a new edition of the telegraph lines comprised in the extra-European *régime*, in four sheets. A fresh general chart of the telegraphic communications of the world has also appeared in one large sheet, showing the modifications which have occurred since last November.

Election Returns.—The demand for telegraph election returns is greater than ever this Presidential year, and the Western Union Company will have some difficulty in filling all the orders for special wires in New York, Philadelphia, Boston, Chicago and other cities. In Philadelphia, for example, sixty operators and sixty special wires are to be supplied, but a great many applications have been refused. The charge is $50 for the special service for the night.

Producing Telegrams.—A special dispatch from Laramie, Wyo., of Oct. 17, says: Dilks Black, manager of the Western Union telegraph office at this point, who was fined $100 and committed to jail Monday for failing to produce certain telegrams bearing on a case being tried in the district court, was released yesterday. He was advised by the general solicitor of the company to furnish the messages asked for. Judge Saufley then remitted the fine, but required the manager to pay the costs.

THE TELEPHONE.

Anderson, Ind.—The Central Union Telephone Company has taken down its wires and poles.

Montreal, Can.— The Bell Telephone Company, of Canada has given notice that its subscription rates from January, 1889, will be $25 per annum. A pro rata rebate to present subscribers is to be made by an extension of their leases. The old rate of the company was $50. The rate of the new competing Federal Company is $35.

Lafayette, Ind.—The Lafayette *Courier* in speaking of the poor telephone service in Logansport, says: "The situation in Lafayette is nearly as bad. Where at one time nearly 300 instruments were in use here, the toll system has reduced the number to less than 100. The utility of the instrument is destroyed, and the majority of the people who heretofore used it have accustomed themselves to get along without it."

A Bell Victory.—A dispatch from Chicago of Oct. 29 says: "Judge Blodgett rendered his decision in the injunction case of the Bell Telephone Company against the Cushman Telephone and Service Company to-day, sustaining the claims of the Bell Company and granting the injunction prayed for. The main case was decided some time ago, but the present proceedings were begun to force the Cushman people out of several Indiana cities where they operate exchanges. The defendants claimed that the Bell Company had withdrawn its instruments from these towns on the passage of a State law limiting telephone rates. On this point the court ruled that the fact that the complainant's licensees or grantees have withdrawn their telephonic accommodations from these cities does not furnish any excuse or any defense for the infringement of these patents by the defendants." The injunction will not take effect, however, until Jan. 1 and has been appealed.

Death of Mr. H. P. Frost.—We regret to announce that Mr. Herrick P. Frost died at New Haven, Conn., on Nov. 3, after a year's illness. By a singular coincidence his six months' leave of absence as general manager of the Southern New England Telephone Company expired that day. Mr. Frost had been in the wholesale grocery and liquor business, when in 1877 the first telephone company was organized in Connecticut. He turned his entire attention to the introduction of the telephone, and with George W. Coy, of Milford, Conn., was the first to establish a system of telephone exchanges by means of the switch-board, that system being adopted and improved upon afterward in all parts of the country. Their exchange, one of the first established in the world, began operation in January, 1878. He was the chief organizer of the Southern New England Telephone Company and the Chesapeake & Potomac Company, covering the District of Columbia and Maryland. He was also interested in the New York, New Jersey and Colorado companies.

THE ELECTRIC LIGHT.

Easthampton, Mass., is to have a Waterhouse plant.

Sherman, Tex.—It is stated that Mr. B. Anderson will put up an incandescent plant.

Corning, N. Y.—The Corning Gas Company is a convert to electric lighting and will put in a plant.

Belleville, Ont.—The Belleville Gas Company has increased its electric light plant to 85 arc lights capacity.

Fryeburg, Me.—There is talk of lighting Fryeburg, Me., by electricity, the power to be obtained from a mill a mile away.

Weyer's Cave, W. Va., is to have a Westinghouse alternating plant of 650 lights, the lamps being distributed through the caverns.

Alton, Ill.—The Alton Gas and Electric Light Company, lately formed by A. E. Campbell and others, has a capital stock of $60,000.

Truckee, Cal.—The Truckee Electric Light and Power Company has been formed by W. H. Kruger and others with a capital stock of $10,000.

Portland, Me.—The Consolidated Electric Light Company has the contract for city lighting at $26,000 per annum for 168 arcs and 250 incandescents.

Baxter Springs, Kan.—The Baxter Springs Light and Power Company has been incorporated by A. Warner and others with a capital stock of $20,000.

The Orient Company.—The Orient Electric, Gas and Water Company has been formed at Portland, Me., by J. B. Reed and others with a capital stock of $1,000,000.

Fire at Pittsburgh.—A fire at Pittsburgh on Oct. 29 destroyed the Faraday Carbon Works and 100,000 carbons ready for shipment. The property was insured.

Y. M. C. A., Indianapolis.—A contract has been made with the United States Electric Light Company for a complete plant of 100 incandescents and three arcs for the Young Men's Christian Association at Indianapolis.

Washington, D. C.—The Columbia Conduit and Cable Company of Washington has been incorporated by A. D. Hazen, W. R. Riley, I. L. Johnson, L Somerville, O. T. Thompson and W. A. Thompson, with a capital stock of $500,000.

Indianapolis, Ind.—Articles of incorporation have been filed of the Merchants' Electric Light and Power Company, with a capital stock of $100,000. The directors are R. T. McDonald, J. T. Brush and J. P. Smith, who represent stock to the amount of $55,700.

Westinghouse Plants.—The Keystone Construction Company, E. H. Wells, manager, has closed a contract for a 750-light Westinghouse alternating current station at Beaver Falls, Pa. They have also installed a 75-light Westinghouse isolated plant for the Gerdes Leather Company, Allegheny, Pa.

Charges of Embezzlement.—A special dispatch from Worcester, Mass., of Oct. 29 says: Charles B. Whiting, banker, was to-day arraigned on a second charge of embezzling $7,900, in bonds, of the American Electric Manufacturing Company. He pleaded not guilty and trial was set for to-morrow.

Harrisburg, Pa.—Ground has been broken for the new and extensive plant of the Excelsior Electric Light Company. Mr. J. J. Moore is the contractor. The plant will made be one of the largest and finest of the State. The company lights the city, and intends to put in the Westinghouse system for incandescent work.

Wright Engines.—Mr. Wm. Wright, of Newburgh, N. Y., is just starting a 400 h. p. engine for the Citizens' Electric Light Company, of Brooklyn, for the De Kalb avenue station, which already has two Wright engines of 300 h. p. each. He is also building two tandem compound engines of 600 h. p. each for the Municipal Electric Light Company, of Brooklyn.

Baltimore, Md.—The Harris Academy of Music, Baltimore City, has just been fitted up with a complete incandescent electric light plant, of 800 lamps, Westinghouse alternating system. The installation was under the superintendence of the Marr Construction Company, now located in the city. This theatre is now one of the largest in the country. The lighting is reported to be a grand success.

Wanted in Cincinnati.—David J. Hauss, manager of the Hauss Electric Company, 62 and 64 Murray street, was arrested on Saturday, Nov. 3, by Detective-Sergeant Worldridge, of the Central Office, on a warrant issued in Cincinnati, Ohio, charging him with defrauding Dr. J. V. Hurley out of $4,500 by false representations in selling him watered stock. In Jefferson Market Police Court Justice Ford turned over the prisoner to Assistant District Attorney Thomas and Detective J. W. Ryan, of Cincinnati, and he will be taken West.

Somerville, Mass.—The Somerville Electric Light Company, reports Mr. F. S. Pearson, the treasurer and manager, are putting in five sub-stations of 100 lights each in different parts of the city. The station batteries are charged in series from the central station, the charging circuit being about seven miles in length. They will use a 1,000 volt 40 ampère machine for charging, and intend to add several more stations if the experiment is successful under a thorough test.

Providence, R. I.—The local *Journal* gives nearly a page to an illustrated description of the new station at Providence of the Narragansett Electric Lighting Company. We have already published details of the new plant, which will be among the largest in the country and will be laid out for 10,000 h. p., the initial equipment being 2,000 h. p. Reynolds engines, by E. P. Allis & Co., will be used, of the triple expansion type, and the electrical plant will consist of Thomson-Houston arc machines and motors and Westinghouse alternating apparatus.

Clinton, Mass.—The Bigelow Carpet Company, of Clinton, Mass., have been operating a Brush incandescent plant since 1885. Some of their Swan lamps have made remarkable records in the length of their burning hours. They have recently forwarded to the parent company in Cleveland a lamp which they commenced using on January 25, 1886, since which time it has burnt 7,400 hours, having been in use in the dynamo room, and has not been turned off over a half dozen times since it was placed in position. It has been left in circuit and been always lighted whenever the dynamo was running. The lamp is not as yet burnt out or blackened in any way. It is still burning in the Brush offices in Cleveland.

Mt. Vernon, O.—The Mt. Vernon, O., Electric Light Company has now finished its Schuyler station and plant, and the lights are burning to the satisfaction of the city authorities and the public. The station is a one story building, 40 × 90 feet. The plant comprises three Schuyler 35-arc light dynamos, for street light, and one 45 lighter for commercial lighting, and the dynamos are driven by a 125 h. p. engine from the Taylor Manufacturing Company, of Chambersburg, Pa., and 150 h. p. of boilers. There are about eighteen miles of circuit, and the poles are painted a neat bronze green to harmonize with the trees that environ them. The city contract calls for seventy-four arcs of 2,000 c. p. to burn all night, except four nights a month, for $72 per year. The contract is for five years. The plant was installed by Mr. J. A. Dalzell, of the Schuyler Electric Company, of Middletown, Conn. The local company has a capital of $35,000, all paid up. Mr. P. B. Chase, of Mt. Vernon, is the secretary.

APPLICATIONS OF POWER.

Fort Worth, Tex., talks of having an electrical road 4½ miles long.

New Haven, Conn.—A number of motors have been built and installed by Mr. J. F. Denison, who is also building a dynamo and some other experimental apparatus for the Sheffield Scientific School.

New Orleans, La.—T. Prudhomme, Maurice J. Hart and others, reported as asking for permit to build an electric railroad, contemplate experimenting with electrical motors first with a view to organizing a company to build such a road.

New Bedford, Mass.—The Sprague Electric Railway and Motor Company, of New York, have recently, through their agents in Boston, Messrs. Blake & Sawyer, installed some motors for mill work in Massachusetts. One of them is at the Wamsutta Mills, in New Bedford, where the motor will be used for hoisting purposes, and will be run off of the direct lighting circuit of the mill, which is of the Edison incandescent pattern. Another motor is at the Laurel Lake Mills, Fall River, where it is used for running slashes. The advantages of transmitting power electrically to mills are manifold. In both of these cases the agents of the mills expressed themselves as being very well pleased with the operation of the Sprague motors.

Akron, O.—The Akron *Daily Beacon* of Oct. 13 says: "The electric street cars (Sprague system) have been running regularly on East Market street to-day and they move in tip-top shape. They have been largely patronized, and many people have made the trip by lightning. The herdics have been withdrawn." There are 12 cars of the regular Sprague pattern, operated over 10 miles of track. Before deciding upon any system to be adopted in Akron, a committee of the City Council was appointed to investigate the different systems of electric railway propulsion in use in this country. They visited a number of the principal cities of the East and reported in favor of the Sprague system and consequently the contract was awarded to that company.

PERSONALS.

Mr. Fred H. Whipple has issued his report of public lighting prepared for the special committee of the Detroit Board of Aldermen. It will be remembered that the data compiled for this report by Mr. Whipple was made the basis of his recent publication on "Municipal Lighting." The report is in favor of the purchase of an electric light by the city for its own public lighting.

Mr. G. W. Davenport, of the Thomson-Houston Company, has been interviewed by the Boston *Advertiser* on the subject of overhead wires. He made the point that the proportion of electric light wires is very small, and that if the other wires, telegraph, etc., were put underground the remaining wires, electric light and power, would be too few to be noticed, and could be thoroughly inspected at all times.

Mr. F. B. Rae, who has been engaged on special Gold and Stock work for the Western Union Company in Chicago since his trip to and return from China with the celebrated Mitkiewicz telephone expedition, has associated himself with the Detroit Electrical Works in connection with their electric railway department. Mr. Rae is an electric railway pioneer, and his many friends will wish him abundant success in his new position.

Death of M. Cabanellas.—We regret to learn that M. Cabanellas died a few days since at the age of forty-nine. He was formerly a naval officer, but after the last Franco-German war he devoted himself specially to the problems connected with the electrical transmission of power, and during the time of Marcel Deprez's experiments his name frequently figured in the technical journals. He was an officer of the Legion of Honor.

MISCELLANEOUS NOTES.

The Fort Worth Electric Manufacturing Company has been formed with a capital stock of $100,000.

Eau Claire, Wis.—The National Electric Manufacturing Company of Eau Claire has been incorporated by R. E. Rust and others with a capital stock of $50,000.

Birmingham, Ala.—The Southern Electric Company, of Birmingham, has been formed by E. G. Stevens, Jr., W. C. Harris, Jr., and W. H. McClellan, to carry on electrical manufacturing with a capital stock of $10,000.

Boston, Mass.—The Aldermen have granted, over the veto of the Mayor, the subway franchise recently asked for by H. E. Cobb and others. It is said that there will be a legal fight over this concession of so valuable and exclusive a franchise.

The Bulen Company.—The Bulen Watch, Clock and Electric Company, of New York, has been organized by G. F. Bulen, H. C. Bosworth and W. H. Prall with a capital stock of $25,000.

Franklin Institute Medals.—The management of the Institute invites attention to the fact that it has the awarding of the Elliott Cresson gold medal and the John Scott legacy premium and copper medal, for meritorious discoveries and inventions. Full particulars can be obtained from Dr. W. H. Wahl, the secretary of the Institute.

The Gaynor Electric Company, of Louisville, Ky., have issued a very handsome and complete catalogue of apparatus and supplies for telegraph, telephone and electric light work, including also their rapid fire alarm and police signal system. Some idea of the comprehensiveness of the publication may be formed from the fact that it runs a length of not less than 120 pages.

BUSINESS NOTICES.

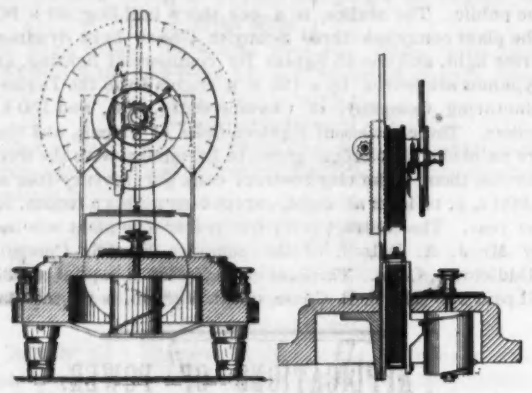
Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine and wood screws, bolt, cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

The Partz Electric Battery Company, of Philadelphia, having found their old quarters at 1,723 Chestnut street too small, have leased the large building at 636 Arch street, same city. They are now prepared to fill all orders promptly, and in addition to their large line of Open Circuit and Gravity and Motor Batteries, have a full line of small Motors and Dynamos. Send for their price list and catalogue, or write to them, stating what you want.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED OCT. 30, 1888.

391,792. Electric Railway; I. W. Heysinger, Philadelphia, Pa. Application filed April 21, 1887. The invention relates to the means whereby one electric railway may cross another, so that trains of cars may move over such crossings at full speed and without interruption of the current, or whereby a train or motor car may move



392,018. ELECTRICAL MEASURING INSTRUMENT.

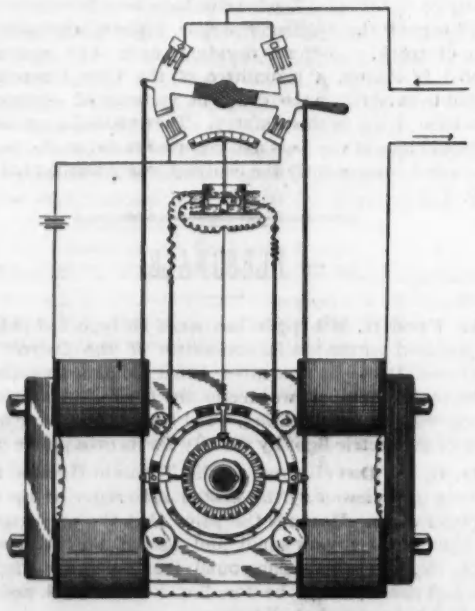
upon a switch from a main track to a sliding or other branch road without loss of power or interruption of the electric current.

391,793. Motor Car for Electric Railways; Isaac W. Heysinger, Philadelphia, Pa. Application filed April 21, 1887. The invention consists in the means whereby the motive power of the motor dynamo is applied to the traction wheels by a motor car.

391,797. Electric Motor; Walter E. Hyer, Newburgh, N. Y. Application filed Oct. 4, 1887. For description see THE ELECTRICAL WORLD, Nov. 12, 1887.

391,815. Manufacture of Incandescent Lamp Filaments; J. W. Packard, New York, N. Y. Application filed April 6, 1888. A method of cementing suitable electrodes to to the carbon strips used in the manufacture of incandescent electric lamps, and at the same time of cleansing the carbon strips, which consists, first, in immersing the carbon strip, the ends of which are held in contact with the ends of the short circuit electrodes in a hydro-carbon oil; second, in connecting one wire of an electric circuit with the carbon strip at a point near one of its extremities, while the other wire is connected to the carbon strip at a point near its other extremity, and then passing a current through the circuit, whereby the greater portion of the current so conducted by the said circuit is passed through the extremities of the carbon strip and the short circuit electrodes, while a less portion is shunted through the high resistance offered by the loop of the carbon strip. See illustration.

391,816. Flashing Apparatus for Carbon Filaments; J. W. Packard, New York, N. Y. Application filed Sept. 11, 1888. In a device for automatically controlling the flow of



391,954. REGULATOR FOR DYNAMO-ELECTRIC MACHINES.

vapor or fluid into a chamber where a vacuum is being created, a tube which opens into the vacuum chamber, a valve for checking the flow of vapor or fluid in the tube, the mercury cup which operates the said valve by gravitation, and a second tube which has one end immersed in the mercury and the other end opening into the vacuum chamber.

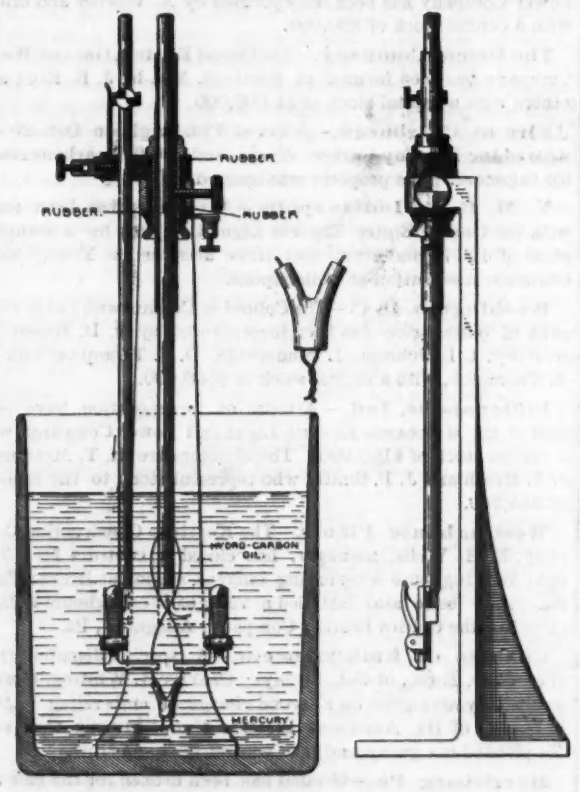
391,839. Individual Signaling Apparatus for Telephones; Edward Davis, Boston, Assignor of one-half to E. B. Welch, of Cambridge, Mass. Application filed Jan. 18, 1884. The improvements relate to the class of individual telephone calls in which a circuit wheel is arranged at a definite point in its rotation wheel to close the local circuit of a bell, and battery is actuated by a mechanical motor and controlled by an electrically vibrated escapement, and consists in unisoning such apparatus and of the circuit closing and secrecy switch devices.

391,853 Cut-Out for Electric Circuits; Henry C. McDill, of Forth Worth, Texas. Application filed Sept. 9, 1887. A cut-out for an incandescent lamp embodying, essentially, a magnet or solenoid in derivation from the filament, spring contacts completing the circuit from the filament to the line on one side, and an armature lever electrically connected with said magnet adapted to disrupt the circuit between said contacts and maintain the continuity of the circuit through itself.

391,855. Circuit-Closing Mechanism; Charles E. Ongley, of New York, N. Y. Application filed Nov. 21, 1887. This invention relates to an electric switch and circuit closing mechanism which is especially designed and adapted for use in connection with appliances for controlling electrically the operating mechanism of an elevator, it being the object of the invention to increase the number of possible electrical contacts and also to secure the automatic breaking of the circuit whenever the hand of the operator is removed.

391,917. Detachable Circuit-Closing Device for Electric Bells and Annunciators; J. D. Randall, Memphis, Tenn., Assignor of one-half to George Schmelzried, Jr., same place, filed May 22, 1888. This consists of a stationary circuit-closer or push-button having additional connections to two sockets into which fit two plugs connected by wires with another circuit-closing device which can be moved about at will. See illustration.

391,923. Systems and Apparatus for Electrical Distribution; M. M. M. Slattery, Woburn, Mass. Application filed April 6, 1887. It comprises as its chief features a number of multiple branch circuits each containing a translating device or devices, such multiples or groups being operated in series, a number of resistance multiple branch circuits, also in series, but in parallel arc with said multiples of translating devices, and conductors between the multiples, together



391,815. MANUFACTURE OF INCANDESCENT LAMP FILAMENTS.

with mechanism for protecting the multiples or groups from injury by reason of undue access of current thereto.

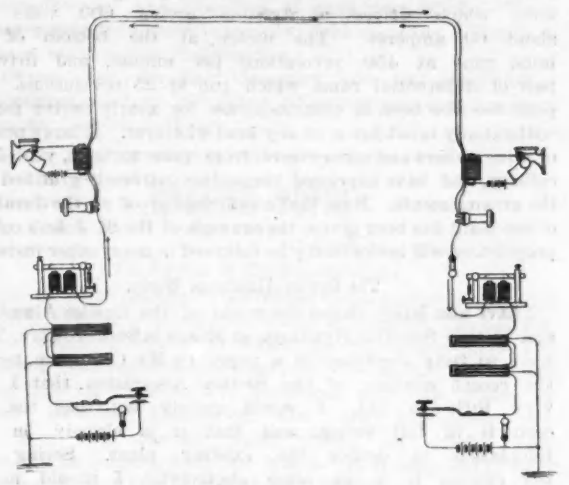
391,943. Electric Switch or Cut-Out; Waldo C. Bryant, Waterbury, Conn. Application filed June 23, 1888. For description see page 255, this issue.

391,954. Regulator for Dynamo-Electric Machines; S. D. Field, Yonkers, N. Y. Application filed Oct. 21, 1887. The object of the invention is to provide a sensitive automatic visual indicator which will at all times show whether the brushes are at the position of least spark or away from it, and if the latter, will show the direction of movement required to restore them and the distance to be moved. See illustration.

391,960. Electric Self-Winding Clock; V. Himmer, New York, N. Y. Application filed Oct. 1, 1887. The invention consists of an electric self-winding clock which is driven by a weight suspended from an endless driving chain, one portion of which passes over a driving spur wheel in gear with the clock train, while the other portion passes over a winding spur wheel that is intermittently actuated by a pawl and ratchel device operated by a transmitting lever from the armature of an electro-magnet.

392,018. Electrical Measuring Instrument; Victor H. Emerson, New York, Assignor of one-half to H. T. Seip, of Easton, Pa. Application filed Feb. 10, 1888. The invention consists in the combination, with a magnetic needle or its equivalent, of two coils of conductors arranged to act oppositely upon said needle, so as to tend to turn the same in opposite directions, and proper mechanism for changing the relative position of either or both of the coils to the needle, so as to permit a balance of inductive actions to be established when different currents are flowing in said coils. See illustration.

392,033. Telephony; W. W. Jacques, of Newton, Mass. Application filed Sept. 10, 1888. A system of simultaneous telephony and telegraphy, consisting of a metallic circuit, including telephone instruments, provided at its ends with earth branches, including telegraphic sending and receiving instruments and a Muirhead condenser. See illustration.



392,033. TELEPHONY.

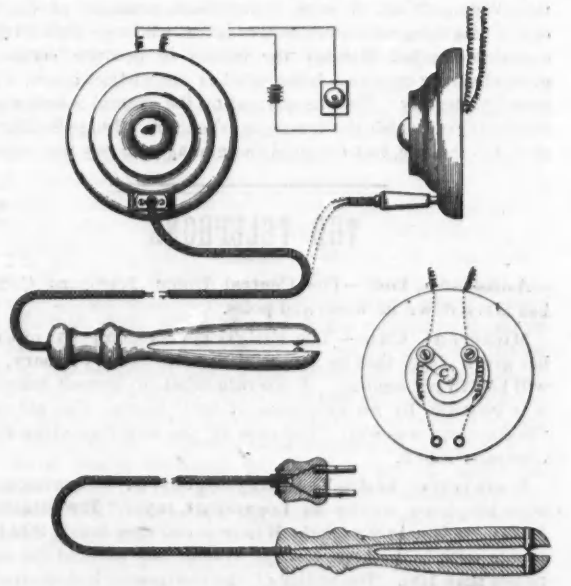
392,034. Electrical Switch; O. B Johnson, of St. Johnsbury, Vt. Application filed Aug. 4, 1888. A spring actuated contact capable of being moved in opposite directions through a given space, a terminal plate or spring and a guide, the terminal and guide being inclined to the normal path of movement of the contact, whereby the contact at or near its limits of motion will pass under and over the opposite ends of the guide and into and out of contact with the terminal, respectively.

392,080. Electrode for Secondary Batteries; G. H. Stout, New York, N. Y. Application filed Oct. 15, 1887. An electrode for secondary or storage batteries, consisting of a perforated sustaining plate or support, having expansible projecting shelves or ribs extending across its face, and inclosing the active material in the perforations and between the shelves and sustaining plate.

392,103. Electric Conductor; Henry F. Campbell, Concord, N. H. Application filed July 7, 1884. An electrical conductor or cable composed of an insulated wire having upon it two conductive coverings insulated from each other throughout the length of the cable and electrically connected together at the ends thereof to form a circuit independent of the central core.

392,127. Insulator for Electrical Conductors; John C Love, Philadelphia, Pa Application filed July 10, 1888. An insulating block having an opening through it and a support for the block with an electrical line conductor having a tongue to enter the opening and a key to secure the tongue.

392,158. Method of Connecting Filaments to Leading in Wires; Hermann Lemp, Lynn, Assignor to the Thomson-Houston Electric Company, of Connecticut. Appli-



391,917. DETACHABLE CIRCUIT CLOSING DEVICE FOR ELECTRIC BELLS.

cat on filed May 31, 1888. A method of connecting a carbon conductor with another body, which consists in forming a deposit upon the carbon by passing a current through the carbon, while the portion of the body to be connected therewith by said deposit is in position to be engaged by said deposit, but out of circuit.

392,167. Automatic Electric Switch; I. L. Roberts, of Brooklyn, Assignor to the Roberts-Brevoort Electric Company, of New York, N. Y. Application filed March 17, 1888. The invention consists of an electro-magnet provided with a spring controlled armature, which, as the attractive power of the magnet increases or decreases, owing to variations in the current, automatically brings into circuit an increased or decreased number of battery cells, or of shunts on the dynamo, as the case may be.